Bulletin on NARCOTICS

Vol. IV, No. 2, APRIL-JUNE 1952

UNITED NATIONS

DEPARTMENT OF SOCIAL AFFAIRS

New York

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Foreword

In accordance with a request made by the Government of Peru (April 1947) to which the Government of Bolivia adhered later (April 1949) the Economic and Social Council by resolution 159 (VII) IV (August 1948) sent a Commission of Enquiry to these two countries in order to investigate the effects of chewing the coca leaf and the possibilities of limiting its production and controlling its distribution. The Commission in the conclusions of its report declared that this habit induces harmful effects and decided in favour of the possibility of suppressing it gradually as well as of the possibility of limiting the production and of controlling the distribution of the coca leaf.

By resolution 395 (XIII) (August 1951) the Economic and Social Council decided to send the report and the additional observations of the Commission to the interested governments with the request for the communication of their observations thereon to the Secretary-General of the United Nations before 1 December 1951. The Council also requested the Commission on Narcotic Drugs to examine the problem of the coca leaf during its seventh session, taking into consideration all available information, and to submit its recommendations on the matter to the Council as soon as might be possible thereafter.

The problem of the chewing of the coca leaf is a complex one. As it is clearly indicated in the report of the Commission of Enquiry many factors—social, economic, medical, sanitary, administrative and also housing, etc.—contribute to its intricacies.

The *Bulletin on Narcotics*, from its inception and in accordance with the purpose for which it was created, has been anxious to publish technical and scientific articles on problems concerning narcotic drugs and related questions in order to make known authorized opinions on these problems and their implications.

Bearing this in mind, the editors have devoted a large part of this issue to the coca-leaf problem. The *Bulletin* requested well-known specialists in the matter to contribute to a kind of compendium of authorized opinions on various aspects of the problem and gave them full freedom to deal with the subject in their field of specialization. The authors approached were: Professor Dr. Alberto Hurtado, member of the Faculty of the University of Lima, Peru; Professor Dr. Vicente Zapata Ortiz of the same Faculty; Mr. Aristides Pacheco Gamboa, President of the Agrarian Society of Cuzco, Peru; Engineer Luis Miñano Director of the Mining Technical Institute, Cerro de Pasco, Peru; Professor Dr. Martín Cárdenas of the University of Cochabamba, Bolivia; Agricultural Engineer Raúl Pérez Alcalá from the Ministry of Agriculture and member of the National Commission on Coca Leaf, La Paz, Bolivia; Mr. Abel Solíz S. from the Association of Landowners of Yungas, La Paz, Bolivia; Dr. Eduardo Malleza, Buenos Aires, Argentina; Dr. Luis A. León, Quito, Ecuador; and Professor Dr. Jorge Bejarano from the Faculty of Medicine, Bogotá, Colombia. Also Dr. Pablo O. Wolff, Chief of the Addiction Producing Drugs Section of the World Health Organization.

As a result of these requests, the present issue of the *Bulletin* contains articles by Messrs. Cárdenas, Pérez Alcalá, Abel Solíz, Zapata Ortiz, León and Wolff.

RUINS OF MACHU PICCHU *Photo: Martin Chambi*

General Considerations on the Problem of Coca-Leaf Chewing

By P. O. Wolff, M.D., Ph.D., M.A.
Chief, Addiction Producing Drugs Section, World Health Organization

In preparing the "Annotated Bibliography on the Effects of Chewing the Coca Leaf",[1] general conclusions were reached which have not so far been published. Consequently, the offer to include them in the *Bulletin on Narcotics* is accepted with pleasure.

Although this paper was written three years ago it is felt that the observations figuring therein are still valid today. These observations have, moreover, been confirmed in the meantime by the important statements formulated by the Commission of Enquiry on the Coca Leaf of the Economic and Social Council. We therefore publish the text unchanged.

The numerous works cited in the above-mentioned bibliography bring out, in our opinion, the great importance of the subject under consideration, namely "the terrible problem of the intoxication", as it was so aptly termed by Carlos Enrique Paz Soldán, Director of the Social Hygiene Institute, University of Lima. With the aim of improving the position, Paz Soldán and some of his compatriots have waged an incessant war on coca-leaf chewing. Among those who have helped in this praiseworthy effort we may mention in particular Luis N. Sáenz, to whom we owe an

[1] *Report of the Commission of Enquiry on the Coca Leaf*, Economic and Social Council, *Special Supplement No. 1*, E/1666, 1950, pp. 119-160.

encyclopaedic work on the question; Carlos A. Ricketts, who attempted, unfortunately without success, to have the necessary legislative measures adopted; and, more recently, Carlos Gutiérrez Noriega and his co-workers, who defined the basic pharmacological and clinical factors of the problem.

The accounts of scientific travellers, especially those of the first half of the eighteenth century, contain information which sometimes should be used only with caution, since despite their remarkable general culture and their extensive knowledge of the natural sciences, and despite their experience in the art of observation, these travellers were not always free from error. Thus the fits of hallucination caused by coca-leaf chewing and described by a traveller as eminent as the archaeologist J. J. Von Tschudi (1832-1842) are "relatively very rare", as observed by Luis N. Sáenz and as recently confirmed by Gutiérrez Noriega.

Such caution is in agreement with the views formulated by H. W. Maier, the Zurich psychiatrist, whose competence as regards cocainism is generally recognized. In his monograph on the question (1926), he states that he encountered so many unsatisfactory features in Tschudi's clinical descriptions that he found himself unable to draw conclusions of a medical nature.[2]

Despite these authoritative criticisms, certain authors never fail to refer to Tschudi's description, considering them an essential source for the discussion of the effects of coca-leaf chewing.

It is, in fact, only within the last few decades that the concepts "habit formation" and "drug addiction" have become more clearly defined, although we still have not thorough knowledge of the mechanism by which they develop within the organism.

It will therefore be understood that observations on coca-leaf chewing recorded about a century ago—including those due to physicians—were relatively vague, since even members of the medical profession could base their opinions only on the scientific knowledge of their period. We would like to stress this point, so as to avoid the mistake made by certain contemporary authors who believe they can gauge the present position on the basis of observations made at the time of the Conquest or during the following three centuries.

This same criterion of judgment should be applied to a work which has often been quoted, the thesis of the famous Peruvian physician, Dr. Hipólito Unanue, entitled "Dissertation on the appearance, cultivation, trade in and virtues of the famous plant of Peru known as Coca".[3] Already in 1913, Hermilio Valdizán, the eminent Peruvian psychiatrist and medical historian, affirmed that this was "an agronomical study and that considerations concerning the effects of coca on the degeneration of the indigenous races should not be sought in it". Consequently, we deem it unfortunate that today the supporters of the continued use of coca by the Indians rely principally on the evidence of Unanue, thus making abusive use of the solid and perfectly well-justified reputation enjoyed by the founder of the Peruvian school of medicine.

For the same reasons, the research carried out and the opinions expressed during the second half of the last century have also been rendered relatively obsolete by present knowledge of drug addiction and the related problems, and are of little use in a modern study of the question, although their authors showed themselves to be already more aware of the nature of addiction. The difficulties encountered in this respect have been very well expressed by H. W. Maier in the monograph previously mentioned, where he declares: "Unfortunately, I have found no modern medical work on the pathological symptoms which develop among coca leaf chewers, no doubt since this addiction is found, above all, in regions which even today are little civilized. Our knowledge of these states is consequently based on the accounts of travellers, and this will continue until such time as these gaps in medical literature are filled by clinical and morbid anatomical studies made on the spot."[4]

However, since this period the position has greatly improved, thanks to research carried out above all by Peruvian workers, who have succeeded in considerably clarifying this problem from the experimental, clinical and social viewpoints.

On the other hand, relatively little is known of the work of Bolivian authors, as is noted, for example, by Aliaga Suárez. Nevertheless, certain distinguished physicians of that country have since expressed their views, and it may be concluded therefrom that they are seriously concerned with this problem.

Articles and reports which do nothing but exalt the "virtues" of the plant represent a factor contributing greatly to increased consumption of coca leaves and the development of the consequences thereof. Certain coca planters went so far a few years ago as to recommend, for example, under the pretext that the leaf contained vitamins, "that exportation be extended to... Europe and other countries where famine is rampant

[2] "Im Uebrigen sind die Krankheitsbilder zu wenig gut geschrieben, als dass sich medizinisch Weiteres daraus ableiten liesse."

[3] "Disertación sobre el aspecto, cultivo, comercio y virtudes de la famosa planta del Perú, nombrada coca" (Lima, 1794).

[4] "Leider fand ich keine moderneren medizinischen Arbeiten über die pathologischen Erscheinungen bei den Kokakauern, was wohl daran liegt, dass diese Sucht ihre stärkste Entwicklung in Gegenden hat, die auch heute noch wenig kultiviert sind. So sind wir einstweilen für die Kenntnis dieser Zustande auf Reisebeschreibungen angewiesen, bis diese Lucke der medizinischen Literatur einmal durch klinische und pathologisch-anatomische Studien an Ort und Stelle ausgefullt sein wird."

among the inhabitants". It is hardly necessary to say anything further with respect to such an attitude.

Luis N. Sáenz points out, for example, that "it is precisely...the owners of coca plantations...who have in all periods brought to nothing the compaigns aiming at the liberation of the Indian from this addiction, even before these efforts commenced, or at their very outset". He recommends, consequently, that "indispensable" measures be taken, insisting that "the State, independently of measures of all kinds adopted to diminish consumption, also intervene to limit production and to submit the producer to strict control..., in order to avoid the coming to pass of what has been observed as concerns other forms of drug-addiction in countries where the drug producers have spread propaganda in favour of narcomania and advocated their baleful industry, defending it in such a way that Legrain was led to say of them, that 'they had, in fact, no heart other than their purse' ".

In this connexion mention should be made of the remarkable Colombian Decree of 17 November 1948, forbidding the sale of coca leaves in markets and in establishments of any kind, with the exception of pharmacies and druggists. In our opinion, this is the first step—an excellent and decisive one—towards remedying and improving the present position.

On the other hand, it must be borne in mind that for the worker in mountainous regions who chews coca, the leaves of that plant have a value much greater than that of money as a constituent element of his wages. It is believed that the Peruvian Indian devotes 25 per cent of his income to purchasing coca leaves. "The whole life of the mountain dwellers", says Sáenz, "circles around coca."

Furthermore, the evil custom of paying part of the wages in coca—sometimes even the greater part—is a special feature of the exploitation of the Indian worker. One of those most familiar with the Indian and his inmost being, the Peruvian writer, Henrique López Albújar, goes so far as to say, "perhaps it is coca which makes the Indian resemble the donkey; but it is also coca which makes this human donkey work without complaint...".

Among the extensive investigations which have been carried out there are some which in our opinion are particularly important, namely those involving observations confirmed by control experiments, so that the results obtained can be compared—in so far as this comparison is possible in dealing with biological phenomena—with the reaction produced in normal persons. In the field of experimental science such a method represents the best, if not indeed, the only way of arriving at the most accurate and precise conclusions possible on biological questions.

It is clear that scientific problems cannot be decided by vote—despite examples of this which may be found in history—and that the opinion of a single worker, although opposed to that of the majority, may in the end be recognized as the correct and true one. Nevertheless, in the present case one fact appears significant to us: the great number of authors who hold the chronic chewing of coca leaves to be harmful as compared with the small number of those who consider it as being harmless. This is shown in the following table:

Opinion expressed	*Physicians*		*Non-physicians*	
	Number		*Number*	
	Of works	*Of authors*[5]	*Of works*	*Of authors*[5]
Harmful effects ...	67	35	20	19
Harmless effects ..	8	8	4	4

The social aspect of coca-leaf chewing has been intentionally taken into consideration. According to personal observations which we made in a region where the coca leaf is chewed, as well as according to the results of discussions which we had with physicians born in those regions and practising there, we feel justified in saying that the problem of coca-leaf chewing, considered as a whole, constitutes nothing more than the last link in a chain, unfortunately all too long, of social and medico-social scourges, which include pauperism, bad housing conditions, deficient nutrition, rudimentary or completely absent education, alcoholism, tuberculosis, venereal disease and other infections, and promiscuity, to mention only the worst calamities and miseries.

Furthermore, it is evident that the chewing of these leaves for pleasure is incompatible with the regular and normal taking of meals. We are convinced that coca-leaf chewing is a social evil; the chronic consumption of these leaves constitutes a social poison which undermines the physical and mental health of the population and lowers its moral and economic level.

In our opinion, the essential measure making effective suppression of cocaism possible is to be found in the improvement of general living conditions, the raising of the primitive population which chews the coca leaf and whose condition very often borders on extreme destitution. Suitable education of Indian youth would certainly yield good results and would reduce the large number of "infra-socials" produced by chewing the coca leaf. The results which have been obtained in evangelized Indian settlements and which have been described by Ricketts and other authors, afford a particularly striking example of this. Christianized Indians, in fact, no longer live in the former wretched conditions and thus show themselves physically and mentally capable of freeing themselves from coca-leaf chewing.

Our ideas are supported by the statement of Huamán Poma de Ayala, "the most extraordinary intel-

[5] The main author of each work has been considered as the sole author, without taking his co-workers into account.

lectual of the Indian race" (Gutiérrez Noriega), who affirms that "by providing the population with abundant supplies of fruit and vegetables the vice of coca-leaf chewing could be abolished".

We hope that we have shown that the coca problem cannot be considered by itself, but that it is intimately connected with the social state of the peoples in question, so that it should be considered against a background much more extensive than that represented by the plant alone.

History shows us that coca-leaf chewing was formerly known and practised in much more widespread areas than today, even as far as Central America (Nicaragua). It is worth while considering more closely the reasons which, in Ecuador for example, have led the Indians, who live at the same altitude as those chewing coca in Peru and Bolivia, to give up this vice.

In the last issue of *América Indígena* (vol. 12, no. 1, 7-32) there is an article by Luis A. León entitled "Historia y extinción del cocaísmo en el Ecuador. Sus resultados" (History and abolition of cocaism in Ecuador and its results). He emphasises the fact that even in pre-Colombian times almost all the inhabitants of Ecuador chewed coca leaves, although this practice has now practically disappeared.[6]

In considering this subject, we must also take into account a question the study of which is still in full course of development, i.e., changes in certain functions and reactions of the organism at high altitudes. There are already numerous observations on this subject, particularly those made by F. Verzár as well as by A. de Muralt, and their respective co-workers in Switzerland. They have studied, in particular, the general functional reaction of the organism, thermal adaptation, etc., changes in the endocrine and vegetative functions, bearing in mind the fact that our therapeutic methods are based in large part on modifications of neuro-vegetative equilibrium. Many phenomena of great interest have been confirmed in this way: increased sensitivity, intensified reflexes, excitation of animal functions, etc., all observations which can only be mentioned in passing here, but which suffice to illustrate the importance of high-altitude physiology. Furthermore, Carlos Monge, who directs the Andean Institute of Biology in Peru, Alberto Hurtado, Professor of Physio-pathology at the University of Lima, and their co-workers, are actively investigating this same subject and have published papers of great value on the question.

We are not yet in a position to evaluate the repercussions which observations of this nature may have on the subject with which we are concerned here. In any case, we feel that the systematic pursuit of studies similar to those which the above-mentioned research workers are carrying on is of the greatest interest. Indeed, certain of these investigations have already reached an advanced stage, particularly as concerns the effects of coca.

We confess to optimism in scientific matters, an optimism which alone, we believe, makes progress possible. Criticism is necessary but, on the other hand, hyper-criticism often kills a seed which should be left to develop. If it has been possible to abolish from the cordilleras of Ecuador the urge to chew the coca leaf, why cannot the same result be obtained in countries so greatly affected by this scourge? The social improvement of the life of the Indian will no doubt open the way to attaining this objective. This is a worthy task —to aid the former masters of the South American continent to attain conditions of life better than those they have so far endured.

For the time being, however, the problem of coca-leaf chewing remains unsolved, like that of the Sphinx which defied the centuries. When will he appear, the Oedipus able to solve the riddle set us by the *Kkoʰa*, a word which signifies in the Aymara language, the plant *par excellence*, the plant above all others?

[6] Editor's note: see below page 21.

Psychological Aspects of Coca Addiction

By Dr. Martín Cárdenas
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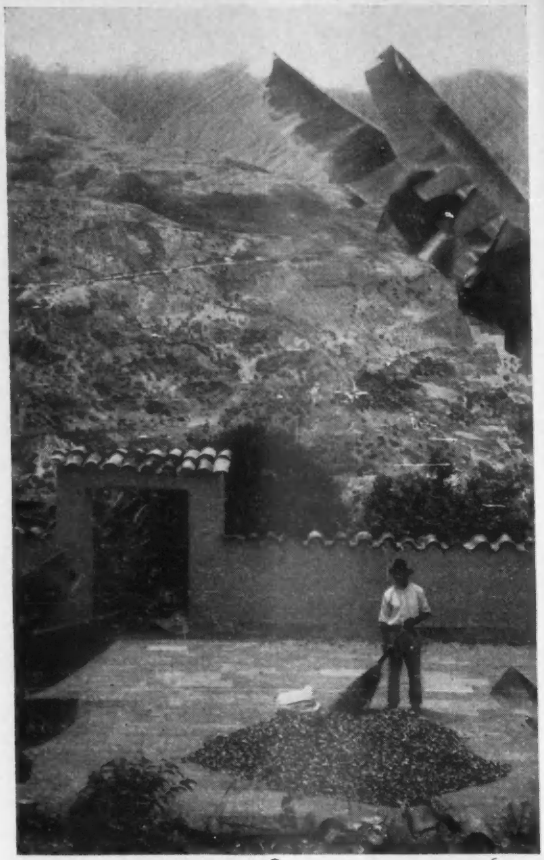

DRIED COCA LEAVES READY FOR SHIPMENT

Although coca addiction or the habit of chewing coca leaf is a social problem which in practice affects mainly Peru and Bolivia, it is now being studied by the United Nations Department of Social Affairs because it is related to the production of the raw material from which cocaine, a narcotic drug subject to international control, is extracted.

Much has been written about the effects of coca-leaf chewing on the organism of the indigenous inhabitants of Peru and Bolivia, and there is an open controversy between those who condemn this practice as a dangerous vice and those who defend it, not so much because it is a valuable element of diet at high altitudes—which is very doubtful—as because it is a century-old custom which cannot be eradicated so long as the living conditions of the population remain as they are today.

In explanation of the existence of these two diametrically opposite positions, it may be said that addiction to cocaine, the extracted alkaloid, is one thing and that coca-leaf chewing as practised by the Indians is quite a different matter. Cocaine addiction is a universally condemned vice of the white race, while the custom of coca chewing has not yet been condemned on the basis of conclusive scientific findings. In this connexion, we might recall the opinion of the distinguished Peruvian physician, Dr. Carlos Monge, who, in commenting on the United Nations Commission's report on the use of coca, called attention to the complexity of the problem and the need to study it more thoroughly.

The European who comes to Peru and Bolivia and observes the indigenous population, not unnaturally bears in mind a picture of the degradation of the white cocaine addict. In these Andean countries he sees a possibly even more striking picture: Indians leading a miserable existence and chewing coca as ruminants chew their cud—a spectacle not likely to please the white visitor's refined taste.

We do not know at what period the American Indians first brought the coca plant under cultivation, any more than we know when they first used tobacco and *peyote (Lophophora)*. We are equally ignorant concerning the domestication of the poppy, betel and Indian hemp of Asia and Africa. It would appear that only the continent of Europe has no native plants from which narcotic drugs are produced. The alka-

loids include some of the poisons most dangerous to man as well as some of the most potent drugs. It is not yet known what purpose these alkaloids serve in the plants which produce them, although it is thought that, being bitter to the taste, they perform a defensive function.

Substances containing alkaloids have been used from the very earliest times for chewing and smoking the world over, either for pleasure, or for some physiological effect, or in connexion with religious ritual. The vegetable substances which are chewed or smoked have a disagreeable taste, and yet man uses them eagerly. Animals would reject such substances, which incidentally have no food value. It would appear that man's nervous system has reached a certain degree of development which enables him to enjoy chewing and smoking substances containing alkaloids. Man's eternal struggle against a hostile environment must have developed in him psychological states of depression, which are regarded as the reason for the consumption of alkaloid-containing plants producing mildly stimulating or euphoric effects. The extraction of these alkaloids in modern times has made it possible to use them therapeutically, in much stronger doses and with much more pronounced effects. It would seem in general that addiction to alkaloids has a largely psychological basis and presupposes a certain degree of development of the nervous system.

The place of origin of the coca shrub *(Erythroxylon coca)* has not been definitely determined, but it is probable that it was cultivated on the eastern slopes of the Andes, long before the formation of the Inca Empire, under conditions similar to those existing today in the Yungas region of Bolivia. According to Rusby, *Erythroxylon coca* is very close to the forest species *Erythroxylon anguifugum*, but is actually a garden species, that is to say a form which has been cultivated so long that it has acquired the status of a species. According to the same author, the Peruvian or Trujillo coca which he calls *Erythroxylon truxillense Rusby*, is a different species from *Erythroxylon coca Lam.*, or the Bolivian and Huanuco coca. Mr. Genter, who is now studying the toxonomy of the cultivated species of coca, maintains that the Rusby species is identical with *Erythroxylon coca* and that *Erythroxylon novogranatense (Morris) Hieron.* is also closely related to *Erythroxylon coca*, although it is sufficiently differentiated to be entitled to specific distinction. Most of the various species of *Erythroxylon* come from the lowlands of eastern South America, Brazil and the West Indies. In Rusby's judgment, if *Erythroxylon coca* is closely related to the Brazilian forest species, *Erythroxylon anguifugum Mart.*, it may be assumed that the coca cultivated in Peru and Bolivia comes from Brazil and Colombian coca from the West Indies.

According to Juan de Matienzo, Judge of the Royal High Court *(Audiencia)* of Charcas, who wrote a history of Peru towards the end of the sixteenth century and who is mentioned by Carl O. Sauer, the cultivation of coca was confined to the warm valleys of the Andes between Guamanga and Sucre and the leaves harvested were reserved for the Inca. According to the same Spanish jurist, control of the use of coca was abolished after the Spanish Conquest, and as a result its cultivation spread to other areas.

Henry H. Rusby, an American doctor and a great expert on South American economic plants who for many years was Dean of the College of Pharmacy of Columbia University in New York City, was sent to South America by the firm of Parke Davis to study the effects of coca on the natives and the possibility of introducing it into Europe and the United States in the form of elixirs and other preparations. Rusby arrived in Bolivia in 1885 and spent several months in the Yungas region near Coroico, armed with some equipment for the chemical analysis of vegetable drugs. At that time he arrived at a very interesting conclusion, which is that fresh—in other words, recently harvested and dried—coca was a very different drug from the coca which reached Europe after many days of travel by land and sea, inasmuch as the two types of coca had different cocaine and other alkaloidal content, owing to the processes of disintegration and reconstitution of those compounds which were caused by the passage of time.

Presumably, those processes occurred in the following cycle: cocaine into cocaicine or cocainoidine into benzol ecgonine into ecgonine into cocaine. This judgment cannot be borne out by our present knowledge of the disintegration cycle of coca alkaloids. A noteworthy feature of Rusby's writings are his observations on the wonderful effects attributed to the coca plant by the Indians of the Andes, who used a residue of coca leaf from which cocaine had already been extracted. His experience led him to think that the highly exaggerated effects of coca, such as endowing the chewer with resistance against hunger and altitude, were due not to cocaine but to other alkaloids. Even granting that the effects of coca were due to cocaine, Rusby pointed out that it was not yet fully known what specific effect that alkaloid had on the human body.

With regard to the effects of coca-leaf chewing on the Bolivian Indians, Rusby says:

"The great difference between native coca and other drugs of its class is that its effects do not greatly diminish with continued use. What it does for the Indian at fifteen it does for him at sixty, and a greatly increasing dose is not resorted to... I myself mixed for nearly a year among a million people who use coca daily without ever seeing a single case of chronic cocaism, although this one subject chiefly occupied my

attention, and I searched assiduously for information... These people have been described as 'weak, puny, and intellectually little above the beast'. So far as this applies, it is a race peculiarity, and it is the more remarkable that such people should perform daily tasks during long lives which would quickly destroy our finest athletes."

My personal observations in Bolivia indicate that habitual coca chewing is confined to the Indian and mestizo (half-breed) classes, although native whites occasionally have recourse to it in special circumstances. During the Chaco War, coca chewing among the mestizo and white Bolivian soldiers was widespread. I have experienced its beneficial effects myself in forced marches on mountain roads at high altitudes. It was formerly customary for secondary school pupils to chew coca leaf when studying for their annual examinations, as the drug was thought to stimulate the mind's powers of assimilation. The infusion of coca as a home remedy against stomach ache is still very popular. Coca really has a disagreeable taste, which, I believe, is the reason it has not been used industrially for the preparation of gaseous beverages and digestive elixirs. Dr. Rusby says that in 1885 coca elixirs to be taken after the evening meal were widely sold in the pharmacies of La Paz.

The Indians chew coca leaf with a special paste made of ash, known as *llukta*, while some mestizos and whites add bicarbonate of soda instead. Those two substances may help to liberate the alkaloids while the wad of coca, which is subjected to sucking for a long time, is gently chewed and impregnated with saliva. Dr. Rusby, on the other hand, believes that the ash is used only in order to improve the taste of the coca, even as salt is used in ordinary food. With reference to the taste of the coca chewed, I have observed in some villages along the upper reaches of the Beni River, that the Indians, after chewing a few leaves of coca, chew a kind of liana called *chamairo*, which has not been botanically identified, and immediately afterwards put powdered ashes into their mouth. In these conditions, the coca is said to have a sweetish taste.

The nutritive value attributed to the coca leaf because it greatly sustains the strength of Indians who live over 3,500 metres above sea level on a diet poor in vitamin content is non-existent and the legend is due to a failure to understand the process of assimilation. The use of coca is not always related to altitude, since there are people, like the Ecuadoreans, who do not chew coca although they live at great altitudes, while in Bolivia there are groups in the Amazon region who chew coca although they live at an altitude of only 200 metres.

In explanation of the power to dispel hunger and thirst, which is attributed to the coca, Dr. Rusby has the following to say:

"A portion of the results here considered are doubtless due to its anaesthetic effect on the stomach. The exhausting effect of hunger, and consequently of labour accompanied by hunger, is not wholly due to a lack of nutrition. The first evil is the nervous waste produced by the endurance of hunger's pangs... These pangs are absolutely allayed by the use of coca leaves. It allays hunger and thirst completely, and thus supports the traveller by removing the chief source of his fatigue. This is a most important action; but I believe that in no other way can the drug be considered as a 'preventer of waste', as we so frequently hear it called. The expenditure of force is possible only by the consumption of energy, and energy implies waste. But through bad nervous conditions energy may be consumed without the production of any useful force. This loss coca tends to check... Thus, by alleviating pain, it leaves the system free to secure the utmost benefit from vital action."

Let us now turn to the psychological aspects of coca chewing, which derive largely from the fact that, as maintained by Rusby, coca deadens hunger and thirst as nervous manifestations, and that its action also extends to higher psychological phenomena, such as the emotions. Let us begin by visualizing the evolution of the indigenous peoples of South America from primitive nomads gathering roots and fruits from the forests to tribes settled in the mountainous regions of the Andes with a highly advanced agriculture.

It is probable that the successive waves of Mongols who migrated from Asia to America some 10,000 years before the Christian era and who belonged to a late Paleolithic culture crossed the continent from north to south and from east to west and came to settle on the banks of tropical rivers where they learned to cultivate maize and other tropical plants. The need for fish and the universal human instinct for adventure probably impelled those early Americans to explore the rivers up and down stream on rafts and in canoes. Adventuring towards the upper part of the tributaries of the Amazon meant freedom from the heat, wild beasts and insects, and resulted in a move to regions which, owing to the altitude, were more temperate, although unwooded. The valleys of the Urubamba and Apurimac in Peru, with their fertile soil, mild climate and many forest plants which could be brought under cultivation, probably represented the last stage in the evolution of these tribes, endowed with great enterprise and highly developed intelligence. These men, who had come from the forest, probably settled down in these regions with the cultivated plants that they had brought from the lowlands, such as maize, *porotos* (a kind of pea), cassava, peanuts, etc., in addition to which they brought under cultivation potatoes and other minor tubers, such as the *quinoa*. Later still, either these same groups or others who came down

from Central America or Mexico presumably reached the northern coast of Peru. This would account for the original settlement of the future builders of the great civilizations of Mochica and Chimú along the coast and of Tihuanacu on the shores of Lake Titicaca. The ancient civilizations of the Old World were founded on an agriculture which consisted largely of the cultivation of cereals, more particularly of wheat, as in the case of Assyria, Babylon and Egypt. Similarly, the civilizations of Mexico, Central America and Peru were able to rise only after the cultivation of maize had become widespread. It may be of interest to note that the best arable lands tilled in the United States and Argentina today were not utilized by the ancient Indians, possibly because the basic agricultural products of the great American civilizations were vegetable species requiring a short day and unsuited to the latitudes in which species imported from Asia and the Mediterranean regions, with their long hours of daylight, are cultivated today and produce remarkably high yields.

The great South American cultures of the Peruvian coast and Tihuanacu indicate a high degree of mental development. As proof of this statement, we may point to the amazing stone constructions of Machupicchu, Saxahuaman, Pissac, Ollantaytambo, Tihuanacu, etc., to the development of an advanced agriculture with a great many varieties of corn and potatoes such as modern agronomy could not produce, and the construction of vast terraces for the conservation of good soil. That being so, it may well be asked what caused the fall of these advanced civilizations of which nothing remains but architectural monuments, the ruins of their cities, temples and tombs in the midst of a solitude barely if at all disturbed by the presence of the Indians of our day, sunk in apathy and indifference which make one despair that they can ever become part of modern life.

When the cultures of the coast and interior of ancient Peru were nearing their peak, the minerals in which the Andes in that region of South America abound, that is to say, copper and tin, were discovered. The metallurgical era, which is synonymous with modern civilization, began in South America, but it could not develop there because the highlands lacked fuel resources. The lack of coal was the tragedy of the entire continent, from Mexico to its southernmost tip. Because the minerals could not be smelted in South America, the cultures described above were checked and started rapidly on a downward course. It may well be that the *Collas* or their ancestors who erected the great monuments which we admire today were aware of their fate and experienced a profound frustration which has left a lasting imprint on the race and accounts for the sadness, apathy and indifference of present-day Indians.

These brief remarks are intended to show the Indian of the Andes not as a man degraded by the vice of coca chewing, but as an unhappy, disillusioned human being robbed of his destiny and made helpless by the lack of natural resources with the aid of which he might have covered the stages that separate him from the level of modern civilization. As we gaze at the passive Indian chewing his coca leaf in his moments of rest or when engaged in the hard manual labour required for mining and agriculture, we feel that he is at the same time meditating on his tragic fate by remembering his past, analysing his present and catching glimpses of his future. Coca chewing is a delicate rhythmic process, in the course of which the Indian chooses one by one the leaves which bring him solace and inserts them into his mouth in a reflex gesture conditioned by his emotional associations, even as the white smoker takes a cigarette from his pocket with joyful anticipation, lights it, inhales the smoke and watches it dissolve in the air, in moments of emotional well-being or depression. The Indian practically never smokes when he chews, while white men smoke most when taking coffee or spirits.

In conclusion, I wish to say that I do not regard as proved the assertion that the Indian's state of mental prostration is the result of coca chewing. Nearly five centuries have elapsed since the Spanish Conquest; in all that time the Indians have gone on chewing coca and yet their mental level does not appear to have been lowered. The use of cocaine for other than medical purposes is to be condemned, but, until I have been proved wrong, I shall not believe that coca chewing is as dangerous as it is said to be. The observer is impressed largely by the fact that it is an ugly and filthy habit.

I believe that the production of coca in Peru and Bolivia should be placed under control primarily in order to prevent clandestine extraction of cocaine in the absence of international provisions governing either the cultivation of or trade in the raw material.

BIBLIOGRAPHY

Henry H. Rusby. "Coca at Home and Abroad", *The Therapeutic Gazette* for March and May, 1888. Detroit, Mich.

George S. Davis, Publisher. *Jungle Memories.* McGraw-Hill, New York, 1933.

Bureau of American Ethnology. *Handbook of South American Indians,* vols. II and VI. 1946 and 1950, Washington, D.C

Hill. *Economic Botany,* McGraw-Hill, New York, 1937.

Cushny, A. R. *Pharmacology and Therapeutics.* Lea and Febiger, 1936.

United Nations. *Bulletin on Narcotics,* no. 1, October 1949, and vol. II, no. 4, October 1950.

The Coca Question in Bolivia

By Raúl Pérez Alcalá
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BOLIVIAN COCA CHEWER *Photo: A. Posnansky*
Courtesy Mr. Raúl Pérez Alcalá

Introduction

Cultivation of the coca plant in Bolivia today represents an important source of revenue, as a high percentage of the inhabitants are addicted to coca-leaf chewing.

As a medicinal herb, coca has a long history which goes back to the Incas and the colonial period, but the Bolivian native's habit of chewing coca leaf during working hours and using it as an essential item of diet originated during the colonial period when the *conquistadores*, convinced that there was wealth in the soil of Peru, used the Indians to mine gold and silver, keeping them supplied the while with coca leaves of which they had learned the anaesthetic properties from the Indians themselves.

The Indian or the half-breed, when employed on the particularly arduous work of minerals deep down in the mines, chews coca leaf in order to mitigate the pangs of hunger and thirst and to be able to make the muscular effort required of him. The effects of coca chewing, seemingly beneficial, are in reality harmful, mentally and physically, to its addicts. The coca chewer is an odd figure: he shuns society and is shunned in return because of the wad of coca in his mouth with its nauseating odour.

The Yungas region, which is where the coca plant is cultivated in Bolivia, lies in the departments of La Paz and Cochabamba and has a very special climate. There is an intensive trade in the coca leaf throughout the western part of the country, especially in Potosí, Oruro and La Paz, but its influence is felt more particularly in La Paz and among the population of the Yungas. The University of San Andrés collects special taxes, and the Society of Landowners of Yungas and the Coca Customs Office owe their existence to the economic value of the coca leaf. Thus this product has become an economic, social and political factor of considerable importance.

Although the theory that the coca leaf has a harmful effect on those who chew it is accepted, economically the opposite is true: greater consumption of coca means greater wealth. Economic laws govern the life of nations and still more the lives of individuals. It will be remembered, perhaps, that England imposed opium smoking in China by force. For the sake of money, man is apt to commit the most inhuman actions and to lose all conceptions of moral value. In Bolivia, whenever any suggestions have been made in connexion with the need to stamp out coca-leaf chewing and to replace the coca shrub by some other commonly-used crop, other interests have always come before those of the nation as a whole. What coca chewing

does to the Indian is of no account. What matters is increased business.

Thus, despite the report of the United Nations Commission which visited the country in November 1949 —a report, be it said, which clearly shows that coca-leaf chewing is harmful and should therefore be abolished—the parties engaged in the lucrative coca trade continue to claim that Bolivian coca has a low cocaine content—from .26 to .50 per cent—as compared with the Peruvian which varies from .80 to 1 per cent; that it is exceedingly rich in vitamins, containing as it does vitamins A, B and B_1, riboflavin, ascorbic acid, biotin, pirodoxin, and the like. The same parties assert that the use of coca is essential at high altitudes. However, although these qualities deserve to be taken into account, it is certain that they neither compensate for nor mitigate by one jot the harmful effects of the coca leaf. For who can deny that the Bolivian Indian suffers from malnutrition and that the coca leaf has made him a repulsive sight?

The traditional sobriety and endurance of the Andean labourer are a myth, as is the conviction which has been gradually fostered that these qualities are due to the beneficial effects of the coca plant. The Indian is neither temperate nor resistant. He does not eat enough because he cannot afford to do so; and on the rare occasions when he can afford to eat his fill, he does not take sufficient nourishment because cocaine debilitates the digestive organs. The wandering Indian of the Andes, who stoically covers hundreds of kilometres with a pack weighing several kilogrammes on his back without feeling real fatigue, is able to do so because of the coca leaf which stimulates his muscular activity. How can an ill-nourished body possibly have endurance? What happens is that for a few short years the Indian makes an effort which is out of all proportion with his real physical powers, and then becomes a human derelict until his death, which usually occurs at an early age.

The opinion of those familiar with the subject is divided. Some maintain, on the basis of scientific studies, that the coca leaf is harmful, while others, subservient to private interests, produce specious arguments to prove that the coca leaf is of incalculable benefit to mankind, both in medicine and in nutrition. Yet, whosoever seeks the real truth in this matter must admit that private economic interests must not take precedence over the health of an entire nation and that the time has come to redress a wrong suffered by the population for hundreds of years. Is it necessary to continue to discuss whether or not coca is harmful? What is necessary now is to find the means of replacing the coca plant by other crops of universal economic value. In a word, I believe that the country's social and economic bonds need strengthening, and the coca leaf seems to be the major obstacle.

The purpose of this article is to spread abroad the views on coca chewing held by Bolivian doctors and others who have studied the problem, and to suggest the substitution of other economically valuable crops for the coca plant.

Bibliography

Very little has been written in Bolivia on the subject of the coca leaf, and such works as exist do not bear the hallmark of patient and careful research.

In chronological order, the weekly *La Epoca* in its issue of 15 July 1945 contained an anonymous article suggesting the establishment of a coca-growers' bank and observing that "coca might be termed the most important plant in Bolivia for domestic and foreign trade".[1] On 18 September, the same periodical published an anonymous article entitled "Virtudes de la coca" which said, *inter alia*: "it would be ridiculously easy to show that of all the known plants, coca is outstandingly endowed with the powers to dispel sleepiness, maintain strength, preserve the teeth and safeguard those who use it from the adverse effects of long fasting".[1] In September 1945, the same weekly carried, in its first, second and third columns, a comment opposing the idea of establishing a coca-growers' bank.[1]

According to Dr. Martín Cárdenas (1932), Professor Cornachea (1916) of the Villazón Agronomic Institute of Cochabamba, now closed, wrote a study on "La Estalla de la coca", a disease the causes of which have not yet been established, maintaining that "it is probably caused by changes in humidity affecting the plants".[2]

In 1933, Dr. Nicanor Fernández wrote a small pamphlet published by the Society of Landowners of Yungas, in which he sings the praises of coca in the following terms: "It is our sincere and humanitarian desire to spread the use of coca among all classes of society at home and abroad in the conviction that we would be doing a service to our fellow-men."[3]

In April of the same year, Humberto Palza published a four-page comment on Professor Claude Joseph's talks regarding the eradication of the Ulo pest (coca-leaf butterfly *Eloria sp.*) by the Odinero wasp.[4]

A brief study on the cultivation of the coca leaf by Sáenz Guerrero appeared in the review *El Altiplano*.[5]

[1] Anonymous. 1945. Weekly periodical *La Epoca* (103): 15-VII; 18-IX.

[2] Martín Cárdenas. 1944. "La Estalla de la coca", *Revista de Agricultura* (2): 45-51.

[3] Nicanor Fernández T. 1932. *La coca boliviana* (Society of Landowners of Yungas): 47.

[4] Humberto Palza S. 1932. *La extirpación de la plaga del Ulo mediante la avispa Odinero* (Talks by Prof. Claude Joseph): 4.

[5] A. Sáenz Guerrero. 1936. "El cultivo de la coca boliviana", *El Altiplano*. 2 (13-14): 21-23.

In *Colonización y Agricultura*, Augusto Valdivia described the life-cycle of the Ulo and recommended methods of control. This work, like the preceding works dealing with coca in its agricultural aspects, indicates no desire on the part of the technicians to promote the cultivation of coca but merely represents a contribution to the study of problems associated with that plant.[6]

In September 1941, Dr. Gregorio Mendoza Catacora published a study entitled *El empleo de la coca en Bolivia*, which was presented to the First National Congress of Medicine, the First Oriental Conference of Rotarians of Bolivia and the Fourth Pan-American Conference of the Red Cross at Santiago, Chile. The author says that "when the Indian chews coca leaf he adds *llujta* (soda ash) producing an infusion in his mouth which brings about almost complete extraction of cocaine. When this juice is swallowed and reaches the stomach, it is mixed with the gastric juices which normally contain hydrochloric acid; this leads to the formation of cocaine hydrochloride which is exactly like the product manufactured in factories and laboratories".[7]

In 1944, the *Revista de Agricultura* published by the San Simón University in Cochabamba, carried an article by Dr. Martín Cárdenas on the *Estalla*, which suggests that this disease is caused by a virus, if the reactions of other plants infected by viruses can be taken as a criterion.

Perhaps the most interesting and valuable work on the coca plant by a Bolivian expert is one written by Dr. Emilio Fernández of the University of San Francisco Javier de Sucre. While it is not, strictly speaking, the result of scientific research, it is based on professional experience and observation. It has the further merit of furnishing a scientific basis for the campaign against the dangerous effects of coca chewing and of inspiring a number of other students to produce works of the same type and with the same viewpoint. Dr. Fernández' article appeared in the *Archivos Bolivianos de Higiene Mental*. It contains some very pertinent observations, such as the following: "Whereas cocaine addiction is associated with night life, with loose women and their lovers seeking to stimulate sexual desire, the coca chewing habit is ingrained among the Indians, the farmers and miners, who use it to arouse physical energy and to deaden pain, loneliness, hunger and thirst... The average quantity of coca chewed a day is 50 to 100 grammes or more, increasing with age and sex (men chew more than women), the type and duration of the work done, the maximum physical effort required and the mental make-up... The adult Indian consumes by chewing 50 grammes of coca a day, and Bolivian coca contains from .75 to .81 per cent cocaine. It might be deduced from these facts that the Bolivian Indian consumes on the average 39 centigrammes of cocaine a day through the digestive system; but if we make every possible allowance and assume that he absorbs only one-third of that amount, the resulting quantity of 13 centigrammes is still a toxic dose. It should be added that the medicinal dosage in, for example, the British pharmacopoeia is 2 to 8 grammes of coca and 1 to 3 centigrammes of cocaine. Consequently, the 50 grammes of coca leaf or 39 centigrammes of cocaine consumed by our indigenous inhabitants represent highly toxic doses, particularly when taken daily all one's life."[8]

The same review reprinted a chapter from Dr. Juan Manuel Balcázar's book *Epidemiología Boliviana*, entitled "Coca y cocamanía". Taking the same position as Dr. Fernández, the author states: "The average annual production amounts to 3 million kilogrammes; in 1944 it was slightly less. The quantity consumed, at the average price of 60 bolivianos per kilogramme, amounts to 153 million bolivianos. Assuming that a kilogramme of coca leaf contains 7.8 grammes of cocaine, 19,890 kilogrammes of cocaine are consumed each year. In round numbers, 20,000 kilogrammes of cocaine are used annually for the intoxication of our working classes. As a gramme of cocaine sells for 20 bolivianos, this intoxication represents 400 million bolivianos which are paid, at the expense of the country's economy, to maintain at least two-thirds of the national population in a state of mental impoverishment and physical prostration."[9]

The *Archivos Bolivianos de Higiene Mental* also published the one technical study available, a study which was the result of patient research conducted on a group of delinquent coca addicts in a prison at Lima, Peru. The author, who rationally planned the course of his inquiry in advance, carefully noted all the relevant data in this work and there can be no doubt that his conclusions are valid. Some of them are as follows:

1. Disturbances of perception found in cases of slight or medium intoxication included changes of visual and auditory acuity and paraeidola, auditory, visual and kinesthetic illusions and changes of temporal perception. In more serious states of intoxication, fantastic visions, macropsia, micropsia, dysmorphopsia, disturbances of spatial perception and in a few cases pseudo-hallucinations and true auditory and visual hallucinations were experienced.

2. Among disturbances of thought, the most frequent are tachypsychism, eidetic representations and obses-

[6] Augusto Valdivia A. 1937. "El Ulo", *Colonización y Agricultura* (11).

[7] Gregorio Mendoza Catacora. 1941. *El empleo de la coca en Bolivia* (La Paz): 8.

[8] Emilio Fernández M. 1945. "La cocamanía en Bolivia", *Archivos Bolivianos de Higiene Mental* (1): 61-84.

[9] Juan M. P. Balcázar. 1945. "Coca y cocamanía", *Archivos Bolivianos de Higiene Mental* (2): 45-51.

sions. In states of great intoxication, there are interceptions, ebullition of ideas, confused thought and automatism of thought.

3. States of autism, full of wish fantasies with an impression of vivid reality, are frequent. This is probably one of the most characteristic disturbances of coca addiction.

4. In some cases perceptive delusions and exaggerated self-importance are present and only in rare cases of great intoxication are there true delusions.

5. Disturbances of the instinctive tendencies (sexual, self-assertive and hunger) are frequent.

6. The symptoms of abstinence are always slighter and less prolonged than those observed in other drug addictions.

7. The symptoms of coca addiction or coca mania are similar to those of cocaine addiction, from which they differ only in that they develop more slowly and the principal symptoms disappear during periods of abstinence.[10]

Lastly, mention should be made of a small work which represents a digest of facts noted by chroniclers and writers of the last century, and which sets out to prove that coca is of benefit as a nutritive element in the Indian's diet. The pamphlet also contains a petition from the Chairman of the Society of Landowners of Yungas to the Minister of Foreign Relations, analysing the position of coca as regards international trade and urging the Bolivian Government to present a formal request that Bolivian coca leaf should be removed from the list of narcotic drugs drawn up by the Second International Opium Conference.

It was impossible to procure publications on the subject by Franz Tamayo, Jaime Mendoza, Alcídez Arguedas, José Agustín Morales and others.

History

Coca was originally cultivated by the Incas, although not on as large a scale as today. The legend is that it was considered sacred and that the nobles burned or chewed its leaves in sign of religious worship.

According to some chroniclers, "the origin of the coca plant as explained in mythology is that a woman who came down from the sky was turned into a coca plant by supernatural powers; the reason for her coming was that men would have something with which to calm and prolong sleep".[11]

In other words, the antiquity of the coca plant, or the period when it was first cultivated in South America, cannot be definitely established. There is proof that it existed before the Incas; this is borne out by discoveries in ancient tombs.[12]

Nevertheless, it has been proved that, as Sáenz says, "the greatness of the Inca empire and the peak of the prehistoric period date back to a time when coca poisoning had not yet begun its ravages".[12]

Enough has been said about the cultivation of coca in the Yungas, but it should be added that trade in the coca leaf has grown to the same extent as the work performed by peasants and miners. In other words, the consumption of and trade in coca have increased in the same ratio as the output of minerals. This means that the country people who habitually chewed coca, but in small quantities, must have increased their rations when they turned to mining, perhaps in the belief that coca was a sure means of sustenance.

Substitution of other economically valuable crops for the coca plant

As previously noted, coca has become an important political, economic and social factor in Bolivia.

In the field of politics, the Society of Landowners of Yungas and the Coca Customs Office make their views heard and wield considerable influence in the national Government. Many members of these institutions hold office in the public administration.

Economically speaking, coca is the most important vegetable export and is consumed in the country itself in large quantities. More than a million and a half inhabitants consume about 4 million kilogrammes of coca leaf a year. The place taken by the coca leaf as an article of national consumption is shown below.

Product	*Tons*
Potatoes	400,000
Maize	200,000
Wheat	100,000
Sugar	46,000
Barley	37,000
Rice	23,000
Coca	4,000
Coffee	1,500

According to the 1948 figures, taxes on coca for that year amounted to 28,963,280.35 bolivianos, the proceeds of the tax being allocated to various institutions in the department of La Paz.

But most important of all is the social aspect of the question. A huge section of the Bolivian population, comprising the ignorant masses (peasants and miners) full of superstitions and prejudices, is addicted to coca-leaf chewing. In the large agricultural section of western Bolivia, the owners pay the miserable wages earned by the peasants in coca, and the latter will not work without an adequate ration of coca leaves. In the mines, coca leaf is the worker's most important article

[10] Carlos Gutiérrez N. 1946. "Acción de la coca sobre la actividad mental de sujetos habituados", *Archivos Bolivianos de Higiene Mental* (3): 67-90.

[11] Melciades Cháves Ch. 1947. "Mitología Cagaba", *Boletín de Arqueología* (Bogotá) (5-6): 437.

[12] Luis N. Sáenz. 1938. *La Coca.* Lima, Peru. 434 pp.

of consumption. It is impossible to say what would happen if the consumption of coca were to be prohibited from one day to the next. Most likely, there would be domestic disturbances with nation-wide repercussions.

For the reasons given above, I believe that cultivation of the coca plant should be abolished, but in such a way as to avoid economic upheavals and social disturbances. In other words, a substitute crop must be sought for coca, and, at the same time, a campaign should be carried on to convince coca addicts that the chewing habit is bad for the health and that the living standard of the workers must be substantially raised.

If it is really desired to eliminate coca consumption, the proper method is to substitute other economically valuable crops for the coca plant. A few ideas on the subject are given below.

In the Yungas the coca plant *(Erythroxylon coca)* is cultivated by primitive methods, which represent no advance over those used in the Inca and colonial periods.

A coca plantation in the Yungas is merely a series of narrow terraces with low sustaining walls built of mud; even so, coca is cultivated with outstanding care if we compare it with the plantations of coffee, citrus fruit trees, bananas, etc., which come next to it in importance. Citrus fruit trees are planted in small irregular groves, coffee bushes are grown as a live fence, and banana trees are planted on steep slopes and are given no care.

When the time comes to replace coca by other economically profitable crops, an analysis will have to be made of all the crops commonly grown in the Yungas, account being taken of the agricultural, economic and social factors involved.

A few pertinent facts are given below.

Coca. According to statistical data, there are about 6,000 hectares under coca in the Yungas region of La Paz, and about 600 in Cochabamba. The yield per hectare is approximately 700 kilogrammes, giving an annual income of some 20,000 bolivianos.

The national production of coca is estimated at 4,500,000 kilogrammes of which over 450,000 kilogrammes are exported to Argentina yearly.

Coffee. Coffee production in the country amounts to about 1,800,000 kilogrammes with an average yield of 2,000 kilogrammes per hectare, the area under coffee being estimated at a little over 900 hectares (tables 1 and 2 below).

In 1947 and 1948, 100,000 kilogrammes of coffee were imported, to a value of over a million and a half bolivianos (table 3).

Table 1

COFFEE PRODUCTION IN THE DEPARTMENTS OF LA PAZ AND SANTA CRUZ
1948-1949

Department	*Production in kg.*
La Paz	1,200 000
Santa Cruz	300,000

Table 2

NATIONAL PRODUCTION, AREA UNDER CULTIVATION AND YIELD
1948-1949

Area in hectares	*Yield per hectare in kg.*	*Production in tons*
900	2,000	1,800

Note: Data supplied by the Directorate General of Rural Economy.

Table 3

IMPORTS OF COFFEE IN 1947 AND 1948

Type of coffee	*1947*		*1948*	
	Kg.	*Bolivianos*	*Kg.*	*Bolivianos*
Coffee in the bean ...	77,434	1,389,853	52,916	907,416
Roasted and ground coffee	9,201	216,814	3,907	282,102
Coffee made from barley, malt, chicory, etc.	1,389	63,366	351	15,864

Note: The rate of exchange is 170.85 bolivianos to the dollar.

From the above figures it will be seen that coffee, with an average yield of 2,000 kilogrammes per hectare, can give an income of 15,000 to 20,000 bolivianos. Coffee has the added advantage that it may be exported to other countries in unlimited quantities.

Tea. The cultivation of this plant is quite new in South America. With the exception of Peru and Brazil, no country has as yet tested it adequately. In Bolivia attempts to grow tea are being made in the Yungas and in Larecaja. The tea produced in those regions is reported to be of good quality and to give a high yield.

Imports of tea to Bolivia between 1944 and 1948 were as follows:

Year	*Kilogrammes*	*Bolivianos (at current rate of exchange)*
1944	137,120	3,978,178
1945	205,860	6,067,329
1946	243,158	7,946,891
1947	178,832	8,063,830
1948	308,469	16,557,150

Note: Data supplied by the Directorate General of Rural Economy.

As shown by the above figures, the consumption of tea in Bolivia has doubled from one year to the next, indicating probable further increases in the future. Moreover, the yields of this product, estimated at 50 grammes per plant, are as high as or higher than those of coca, since it too gives several crops a year.

Both tea and coffee can be exported to the neighbouring countries. The taste as well as the yield of the tea could be greatly improved by, say, importing from the Dutch Indies and other producing countries plants

of a high-yield variety, as that stock will give better results than the seedlings which are now used.

Other products. Apart from the crops mentioned above, citrus fruit trees, bananas, avocados, etc. could be grown in the Yungas, probably under favourable conditions. It may be noted that the Yungas regions, which are the largest producers of citrus fruits and bananas in Bolivia, are barely able to supply the local needs of La Paz, and that there is a large domestic market for those products.

Perhaps one of the most difficult aspects of the coca problem is to find a substitute crop. When it is considered, however, that citrus fruits, coffee, tea, etc., which grow in the Yungas under ideal conditions, are articles of international trade and are urgently needed by the country for its own consumption, and when the idea is accepted that such a replacement of crops would have a beneficial biological effect on a major portion of Bolivia's population, it becomes apparent that action will have to be taken, slowly but surely. Generally speaking, there will be need for a comprehensive campaign through the press and by means of lectures, posters, etc. in all cultural centres and country schools.

To repeat the words of Dr. Saravia: "We must take away from the Indian the vice of coca so that he will feed himself better, or feed him better so that he will forget the vice of coca."[13]

[13] Hugo Saravia B. 1945. *Alimentación racional* (La Paz).

Conclusions

1. Ninety per cent of the coca produced in Bolivia is consumed by the indigenous population and the rest is exported.

2. No clinical or laboratory studies have been made so far on the biological effects of coca chewing in Bolivia, but several Peruvian studies, based on research, prove that coca has a pernicious effect on the human organism.

3. The time has come to initiate measures for the substitution of the coca plant in the Yungas by other economically profitable crops. This problem should be studied and the possibility explored of raising tea, coffee and various kinds of fruit, account being taken of the social aspects affecting the consumer and the economic effects likely to be felt by the producer.

4. From a human standpoint and even more so from a national point of view, the obligation to initiate a campaign against the use of coca can no longer be evaded.

Works consulted

(other than those indicated in footnotes)

Acosta, Joseph. 1590. *Historia natural y moral de las Indias*: 633.

Fossati, Humberto. 1948. *Monografía de Nor y Sud Yungas.* La Paz, 179 pp.

Guamán Poma de Ayala, Phelipe. 1584-1614. *El Primer Nueva Crónica y Buen Gobierno.* Annotated by A. Posnansky, 1944. 179 pp.

Menesas, Raúl. 1948. "Provincia Nor Yungas; Provincia Sud Yungas", *La Paz en su Cuarto Centenario,* pp. 159-183, 185-217.

Limitation of the Production of Coca Leaf in Bolivia

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The conclusions and recommendations of the United Nations Commission of Enquiry on the Coca Leaf, which visited Peru and Bolivia at the invitation of the Governments of the two countries, have thrown into sharp relief the problem of the chewing of the coca leaf.

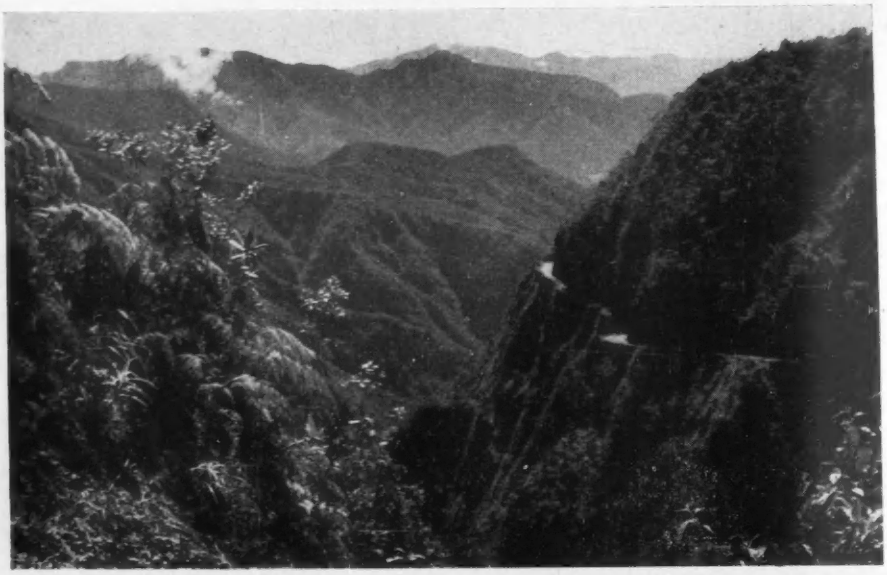
A careful analysis of these conclusions and recommendations justifies the statement that the chewing of the coca leaf does not, except in rare instances, constitute a vice, but represents a pernicious habit of nutrition, if we may dignify by that name the latent undernourishment of the large majority of the population which indulges in this habit. The aim should therefore be to eliminate it gradually and in that way to improve the social and economic conditions of that part of the population.

In our view, this task has two aspects: on the one hand, there is an imperative need for progressive limitation of coca-leaf production until it has been completely abolished, and on the other, the country's agricultural production must be encouraged. In other words, if social upheavals are to be avoided, agricultural production ensuring a better and more balanced diet must be increased in proportion to the decrease in coca production.

The limitation and suppression of the chewing of coca leaf is therefore not an isolated problem. Complete suppression, without the provision of substitute foods, may have all the serious consequences of a famine.

To increase agricultural production is a more complicated problem than to suppress coca-leaf production.

Bolivia is a single-product country; its greatest economic potential lies in the exploitation of the mines. The reason its agriculture is in such a state of utter neglect is precisely that coca was found to provide an easy means of stilling hunger, even though



COCA ROAD IN THE PROVINCE OF NOR-YUNGAS

from a social point of view it resulted in the prevalence of an intellectually and morally backward population which is an obstacle to the country's general progress.

Having neglected its agricultural production and concentrated its productive capacity on mining, Bolivia is faced with a distressing situation. The proceeds from the sale of its minerals, in particular tin, are used to import most of the basic necessities. Wheat, sugar, meat, rice, dairy products, fats, vegetable oils and an endless number of food products are what it receives in return for its minerals.

It is easy to understand what a few cents difference in the price of its minerals means to Bolivia. The question of tin, therefore, must not be regarded as an ordinary business matter; this important resource must be viewed from a wider angle in conjunction with the primary objective of encouraging agricultural production in the country.

We welcome the recommendations of the United Nations Commission of Enquiry on the Coca Leaf. The Government is studying the problem with interest, and is anxious to take measures to limit the production of coca leaf and eliminate its consumption; public opinion is in agreement with the recommendations, but their implementation is more difficult than it may seem. It involves the replacement of this means of nutrition by a more proper and reasonable diet.

The replacing of coca-leaf cultivation by other crops of greater economic value is not difficult in itself. Recent technical studies have shown that coffee may be cultivated in all the regions where coca is now being produced. By organizing the export of coffee from Yungas we could obtain a price of 5,500 bolivianos per quintal of coffee as against only 3,000 bolivianos per quintal of coca, with the added advantage that the cultivation of coffee is much easier and less costly than that of coca. Moreover, substitution by this exportable product would strengthen the gold resources of the country.

In order to bring about this replacement of coca cultivation it will be necessary to request technical and economic assistance from the United Nations, which would be in line with its own recommendations.

Furthermore the control of the production and consumption of coca leaf will require the organization of a State monopoly based on the industrialization of production, the result of which will be that a large part of such production will be diverted from coca chewing, and transformed into goods for export.

Bolivia offers immense possibilities for agricultural exportation; it has a variety of climates enabling it to be self-sufficient in all kinds of products. The industries it has created are not based on domestically-produced raw materials. Such production must be organized, and the land laws must be amended to ensure the standard of life to which Bolivia is entitled, within a system maintaining the distinction between capital and labour.

As will be seen from these brief observations, we agree with the conclusions and recommendations of the Commission of Enquiry on the Coca Leaf, and this attitude was not determined by the recent studies and observations on the subject since we publicly upheld the same views ten years ago.

The Coca-Leaf Problem in Colombia

Coca chewing and cultivation of the coca shrub exist in Colombia but on a much smaller scale than in Peru and Bolivia. The regions of consumption and cultivation are limited to certain districts of the departments of Cauca and Huila. It might be of interest to the readers of the *Bulletin on Narcotics* to have in summarized form the information submitted by the Colombian Government concerning its efforts to fight the production and the consumption of the coca leaf. This summary has been prepared on the basis of the reports (1946-1950) sent by the Colombian Government in accordance with article 21 of the 1931 Convention.

In 1947, the Colombian Government issued the following decree:

"Decree No. 896 of 1947

"*Whereas* in accordance with the Conventions signed in Geneva in 1925 and 1931 the Republic is pledged to supervise the production, manufacture, distribution and sale of narcotic drugs; and

"*Whereas* article 1 of Law No. 45 of 1946 prohibits the cultivation and preservation of plants from which the said substances may be extracted; and

"*Whereas* in accordance with article 27, section 1, of Decree No. 2127 of 1945, employers are forbidden to pay wages in kind, vouchers, tokens or by any other means replacing the legal currency of the country,

"It is decreed that:

"*Article 1.* The payment of wages or of any kind of emoluments wholly or partly in alcoholic beverages or in coca leaf is prohibited, and agreements or contracts for service containing any such stipulations shall be null and void.

"*Article 2.* All persons contravening this regulation shall be punished by fines ranging from one hundred (100.00) to five hundred (500.00) pesos, or by imprisonment in lieu of such part thereof as may be provided for by law, such penalties to be imposed by labour inspectors, justices of the peace and other health or police authorities.

"*Paragraph.* In cases of repetition of the offence, the penalties shall be those prescribed in article 270 of the Penal Code.

"*Article 3.* In accordance with the provisions of article 1 of Law No. 45 of 1946, the cultivation of coca trees *(erythroxylon coca)* and varieties thereof and of *cannabis sativa* (marihuana) and the distribution and sale of the leaves of these plants, are prohibited in the territory of the Republic.

"*Article 4.* Justices of the peace, *corregidores* and other health and police authorities shall destroy plantations of such trees and confiscate leaves found in the market, other than coca leaves belonging to duly authorized pharmacies, provided that those establishments duly declare them within a period of forty days from the entry into force of this Decree.

"*Article 5.* Any person on whom morphine, cocaine, heroin or any other narcotic drug is found and who has no legal permission to possess them, shall be considered as an illicit trafficker and shall be liable to the penalties prescribed by article 1 of Law No. 45 of 1946.

"*Article 6.* Justices of the peace, *corregidores* and other health or police authorities failing, in any such case, to lay any information before the criminal courts against persons violating this regulation, shall be fined from fifty (50.00) to two hundred (200.00) pesos by their respective superiors, for the first offence, and by removal from office on a second offence."

(Signed) Mariano Ospina PÉREZ

(Signed) Jorge BEJARANO
Minister of Hygiene

This decree set off a sharp controversy and in order to collect authorized opinions Dr. G. Bonilla Iragorri, Departmental Director of Health of Cauca, distributed the following questionnaire among medical practitioners in the department:

(*a*) What is your opinion on the consumption of coca as a nutritional factor, an economic factor and a social factor?

(*b*) Do you believe that the Government should continue to allow Indians to consume coca leaves daily?

The answers to this questionnaire were summarized in vol. II, no. 4 of the *Bulletin on Narcotics*. They aimed at establishing that:

1. Coca is not a food;
2. Coca is a toxic and like all toxics is harmful;
3. Mastication can only be considered as a social evil;
4. Chewing must be suppressed.

The opposition to Decree No. 896 took, however, such proportions that the Government of Colombia was compelled to suspend its application.

In a memorandum submitted by the Ministry of Health to the Colombian Congress, the difficulties encountered by the Colombian authorities in their struggle against the chewing of coca leaf are described as follows:

"From time immemorial the vice of coca chewing has existed as a legacy of Inca days in some districts of the departments of Cauca and Huila, where it is undermining the health and racial vigour of the Indian population and threatening to spread to neighbouring agricultural areas. The gravity of this problem lies not only in the harmful effects of the drug but in the fact that, because of the false sense of repletion it gives, coca-leaf chewers use it as a substitute for food, become victims of malnutrition and easily fall prey to epidemics — in particular to the deadly scourge of tuberculosis. The elimination of this vice, though a simple matter in appearance, meets with enormous obstacles. The greatest is the community of interest, in this connexion, between the Indian worker, an addict by tradition and heredity, and the employer who exploits this habit and reaps the benefit of a labourer who eats little and goes all through the working day without taking time off to eat or rest after meals. To combat this vice, Decree No. 896 of 1947 was issued, ordering the destruction of plantations, the confiscation of stocks of coca leaf and the prohibition, under penalties, of the payment of wages in coca leaf — the practice in the districts concerned. The decree aroused a veritable storm among the interested parties, both employers and workers. The former felt that their pecuniary interests were affected, while the latter, feeling that a blow had been struck at one of their most cherished habits, went so far as to threaten rebellion. The Ministry was compelled by this situation to issue Decree No. 1472, postponing the earlier Decree and providing for the gradual replacement of coca plantations by food crops adequate for the needs of the districts involved."

In its report for 1948, the Colombian Government described the situation concerning the coca-leaf problem as follows:

"As a rule the coca shrub is not cultivated as an independent crop; it is generally subsidiary to other crops such as coffee, maize and bananas. In accordance with resolution 578 of 1941, trade in the coca leaf is subject to a permit from the health authorities of its place of cultivation. The inspectorates of the national health police and the departmental health directorates are responsible for controlling its distribution. Government warehouses do not purchase the leaf which is bought by pharmacies and laboratories for the preparation of extracts or tinctures. The Decree No. 896 of 1947 prohibited the payment of wages and remuneration of any kind whatsoever in coca leaf. It also forbade the cultivation of the coca shrubs and its varieties and the distribution and sale of the shrub. In view of the serious difficulties which arose when an attempt was made to put this measure into force Decree No. 1472 was issued during the same year to postpone for one year the effect of article 4 of Decree No. 896 ordering the destruction of coca-leaf plantations and to provide that a census should be taken of coca-shrub plantations with the following particulars: number of shrubs, areas under cultivation, number of proprietors, approximate value of the plantations and annual production in kilogrammes. In Colombia neither crude nor refined cocaine nor ecgonine are manufactured. There are therefore no establishments for that purpose."

In the same report, the Colombian Government stated that Decree No. 3822, 1948, had been issued forbidding the sale of coca leaf in public markets, shops or places of sale other than duly registered pharmacies and drug dispensaries. The text of this decree is as follows:

"Article 1: As from the date on which this decree comes into force, the sale of coca leaf shall be prohibited in public markets, shops or any place of sale whatsoever, other than duly registered pharmacies and drug dispensaries.

"Article 2: If a person is guilty of a contravention of these provisions he shall be punished by the confiscation of the coca leaf and a fine of not less than 100 nor more than 500 pesos which can be converted into a term of imprisonment at the statutory rate; these penalties shall be imposed by the authorities specified in the following article.

"Article 3: Departmental and municipal directors of public health, directors of health centres, national laboratory and pharmacy inspectors, national or municipal health inspectors, mayors, judges *(corregidores)* and police authorities, or the persons acting in their stead, shall be responsible for ensuring strict observance of this decree.

"Sole paragraph. If any person holding authority as above stated fails to ensure the observance of this provision he shall be punished by his competent superior by a fine of fifty pesos for the first offence and dismissal from his post for a subsequent offence.

"Article 4: This decree shall come into force on the date of its approval and shall be publicly proclaimed in all the municipalities of the country".

In 1949, the Cauca Departmental Directorate continued its campaign against coca-leaf chewing. The Departmental Director, however, was compelled to report that it had been impossible to destroy the planta-

tions because the municipal authorities themselves were opposed to it.

The following communication from Dr. Jorge Bejarano, then Minister of Health, to the Municipal Council of Bolivar illustrates the difficulties arising in respect of the destruction of coca plantations:

"I have received your letter no. 254 of 27 April last, containing a proposal approved by your corporation, relating to the campaign against the cultivation of and trade in coca leaves. The above-mentioned proposal states that one of the most serious problems affecting that region is the control, and prosecution of owners and the destruction of coca plantations without compensation, a measure which will cause prejudice to thousands of our fellow countrymen. In the opinion of this Ministry, whose primary obligation is to defend the health of our compatriots, the greatest scourge afflicting your municipality is the vice of coca-leaf chewing which ruins the lives of most of your people, and which I am hoping to combat as successfully as I have combated chicha since I place my faith in the good sense of the leaders of your community, amongst whom I must assign a prominent place to you. The Government could hardly compensate the coca-leaf growers, since under the provisions of Act 45 of 1946, which is part of the Penal Code, the cultivation, possession, sale or distribution of coca is an offence punishable by a prison sentence of six months to five years and a fine of 50 to 1,000 pesos (US$25.65-513). As regards the commercialization of coca-leaf production, as would appear to be suggested in the proposal to which I am referring, I am sorry to have to inform you that the consumption of cocaine, according to the statistics compiled by the Central Opium Board, is decreasing as it is being replaced by synthetic anaesthetics, which are less toxic and not habit-forming."

In 1950, however, new efforts were made regarding the suppression of the chewing of coca leaf, efforts which are described in the following circular of the Ministry of Health sent to the Public Prosecutor's Office:

"Sir,

"I wish to draw your attention to the fact that the Ministry of Health is proposing very shortly to initiate an active compaign for the complete abolition of coca plantations on national territory, as a means to stamp out this vice among the people. This campaign will be carried on in compliance with the laws in force, a copy of which is attached herewith, and plantations will be destroyed after payment of compensation to the owners. As I am hoping in this task to receive the collaboration of the police authorities coming under the Public Prosecutor's Office I venture to inform you that the Ministry of Health would be grateful for any suggestion which you may care to make for the co-ordination of this collaboration in order to render it as effective as possible. After study of the suggestions, which you may see fit to make, this Department will proceed to consider which would be the most suitable date to start the campaign. Studies of the zones in which the plant was cultivated have already been made and the number of shrubs in existence has been more or less determined. A plan has been suggested to compensate the cultivators not by means of cash payments, but by replacing their coca plantations by other more suitable crops, on which subject we are receiving advice from special agricultural experts. Material will also be provided for improvement of farms — barbed wire fencing, fertilizers, seed, etc."

In its report for 1950, the Government of Colombia mentions also that immediately upon being notified of the publication of the report of the United Nations Commission of Enquiry on the Coca Leaf in Peru and Bolivia, the Narcotic Section of the Ministry of Health requested the Economic and Social Council to supply copies of the document, which were transmitted in due course. The report adds that this study will be of great value in the campaign now being undertaken in Colombia to combat the vice of coca-leaf chewing.

The Disappearance of Cocaïsm in Ecuador

By Luis A. León

The Bulletin here presents, with the author's consent, some extensive extracts from an article published by Dr. Luis A. León in the review América-Indígena, *quarterly organ of the Inter American Institute of Indigenous Studies, vol. XII, no. 1, January, 1952.*

When necessary, these extracts have been linked together by brief summaries of the paragraphs omitted.[1]

This article shows a totally different aspect of the over-all description of coca addiction in South America by revealing that the Ecuadorean Indians, who had been addicted to coca for centuries, have now completely abandoned the habit. The author concludes that the abolition of coca addiction has greatly contributed to the progress of the Ecuadorean Indian, both physically and mentally.

The interesting fact concerning Ecuador's position as regards the coca problem, is that this country, which was part of the Inca Empire and therefore was familiar for many centuries with the habit of coca-leaf chewing, has now completely abandoned it and might therefore serve as an example in the research now being carried on into the possible results of the habit's abolition.

Although the quantity of documentation on coca addiction in Ecuador is far smaller than that referring to Peru, there are indisputable archaeological proofs that the habit existed.

Coca addiction in pre-Inca days — archaeological proofs

Medical archaeology and the works of the chroniclers reveal that in the days before the discovery of America by Columbus, the use of coca was widespread almost throughout the country. Our archaeological collections are rich in ceramic figures representing men chewing coca: they have in their mouths one or two rolls of coca revealed externally by a globular protuberance in one cheek.

There are archaeological proofs of the existence of coca addiction on the coast and in the mountains. Coca-leaf chewing was a part of the ritual of certain tribes.

It would appear that coca addiction was a native vice amongst the early inhabitants of Ecuador. It is, however, difficult to make any definite statement beyond saying that at the time of the Spanish Conquest the use of coca was widespread in the area which is now Ecuador. The chroniclers give detailed descriptions of the coca-leaf chewing habit, and of the cultivation of the coca shrub and the effects of the plant. Coca at that time grew in all parts of the present territory of Ecuador, including the eastern region, from which it disappeared many years ago.

At the beginning of the seventeenth century, the cultivation and consumption of coca were practised on a large scale even by clerics, and Juan de Mañozca, a celebrated inquisitor, was greatly incensed by the practice.

The notion of the strengthening effects of coca-leaf chewing influenced even the thought of our famous historian Father Juan de Velasco. This disciple of Loyola wrote in 1789 concerning the characteristics and virtues of the plant:

"Coca is a small shrub, light green in colour, with leaves somewhat resembling those of the orange tree; they are extremely strengthening and provide a food of incredible virtues, since the Indians, with no other provisions beyond these leaves, make journeys lasting for weeks, and appear to grow stronger and more vigorous every day. There is trade in this plant in nearly all parts of the country."

Coca did indeed form the object of commercial transactions: according to Dr. Gualberto Arcos: "the

[1] Passages in italics are summaries of those passages not reproduced in full. — *Editor's note.*

trade in this plant reached fabulous proportions in colonial times, as exports are reported to have reached the value of 800,000 pesos per annum, which would be an immense quantity even today".

After the colonial period, the trade in and use of coca in Ecuador not only decreased but disappeared entirely, and there is accordingly very little mention of the plant in the period subsequent to the rise of the independent Republic; brief reference is made to the problem of the effects of coca in books of history, botany and pharmacology and these reveal the same differences of opinion as are observable in the writings of former times.

Disappearance of coca addiction in Ecuador

In 1911 the eminent Ecuadorean botanist Dr. Luis Cordero was already doubtful as to the existence of coca in Ecuador, as appears from his words:

"Erythroxylon coca: Some landowners in the Sanaguin area, in the western part of the province of Azuay, affirm that that very useful plant known as coca is produced in this area; but we cannot prove that it is so, and it may be that the persons who affirm it are mistaking some related plants, of which de Candolle lists more than twenty, most of them American, for the true coca plant. Be that as it may, the true species so highly valued by the Indians of Peru and Bolivia for purposes of chewing, and in modern times so useful in medicine for the anaesthetic properties derived from the cocaine content extracted from the leaves, might well be cultivated. As regards the first quality, it is well known that the Indians work long hours with no food only chewing a few dried leaves of this plant two or three times a day, flavouring them with powdered lime which they carry for the purpose. They say that this chewing induces a pleasant narcosis, comparable to that produced by opium although it is neither so serious nor so harmful. Lindley, however, says in his *Treasury of Botany,* in the article on coca, that persons who become addicted to coca-leaf chewing rarely attain old age."

In his *Botánica Médica,* Dr. Marco T. Varea says of this plant: *"Erythroxylon coca:* This is the coca which grows in the eastern regions of our territory, and is the same as that found in the hot regions of Peru and Bolivia and in Brazil. It is of considerable value in certain districts where the inhabitants use it on long journeys as it enables them to remain a long time without food, since it suffices for them to chew a few coca leaves mixed with the ashes of the same plant or of *Cecropia peltata,* known in the Amazon region as *ambauba* and amongst us as *guarumo."*

Professor Bejarano, in his interesting work, *El Cocaísmo en Colombia* states that "the habit of chewing coca has persisted for centuries amongst the aboriginal inhabitants of certain South American countries; the vice was particularly prevalent amongst the indigenous inhabitants of Bolivia, Peru, Ecuador and Colombia".

It is well that this distinguished health expert referred to Ecuador in the past tense. This statement by Professor Bejarano inspired Dr. V. Gabriel Garcés to make a correction, and to point out that "The Ecuadorian Indian does not use coca and probably has no knowledge of it at the present time, or it may be that he knows of it and uses it in very small quantities and in purely exceptional cases." The psycho-analytic and sociological explanations given by Dr. Garcés for the use of coca are both original and important.

In 1946, Dr. Buhler, in a well-documented monograph, indicated that the use of this plant was still widespread, particularly amongst the Quechuas and Aymaras in Peru, Bolivia and the border regions of Chile and Argentina, and had spread beyond those limits to the nearer valleys of the Amazon, and went on to state: "In northern Peru and particularly in Ecuador, coca has now almost entirely disappeared, but in former times it was very well known."

Five years ago I myself also stated that coca-leaf chewing had almost died out in Ecuador. The million Indians composing the many communities of the Ecuadorean plateau have completely abandoned the custom of chewing coca leaf; the *Cayapas* and the *Colorados* who inhabit the forests of the west may possibly use it sporadically. The Indians of our Amazonian region, and particularly the Yumbos and Jívaros would seem still to use coca when on a journey, in moderate quantities and unknown to the white man; during my travels through the Napo-Pastaza province, I was unable to observe that the Indians accompanying us made use of coca; I did, however, find that on these journeys they consumed large quantities of *mashato* or *masato,* prepared on a basis of yucca, a drink to which they attribute a great strengthening power. No mention is made in the works of the explorers and scientists who have travelled in the eastern region of our country of coca-leaf chewing amongst the natives of eastern Ecuador.

The pharmacies of the country obtain coca leaf for medical purposes in the neighbouring countries; they also obtain very small quantities from the parish of Maldonado (Carchi province) and areas near Curaray (Napo-Pastaza province), where the plant is grown on a very small scale.

It can therefore be stated that coca-leaf chewing is practically non-existent in Ecuador; this custom of the aboriginal inhabitants of South America has become a thing of the past, and Ecuador is free of one of the social problems of gravest concern to Peru and Bolivia.

Causes of the disappearance of coca addiction. Colonial legislation and policy

What are the reasons for the disappearance of coca-leaf chewing in Ecuador? Our sources of information do not enable us to indicate the most effective measures which have led to the total abolition of this vice. We shall, however, endeavour to discover what these were by following the course of history.

At a certain period of the Inca Empire, the use of coca by the common people was strictly prohibited; it was a mystic plant, reserved for the use of the Inca and for religious ceremonies; later the *shaman* used it in the treatment of sick people; it was only during the decadence of the Empire that the use of coca spread to the people as a whole, and it was for that reason that the Spanish conquerors found that the vice had become a daily habit with the aboriginal inhabitants of Ecuador.

Many chroniclers of the time of the Conquest refer to this habit, of which the conquerors took advantage to exploit the Indians.

The increase in coca addiction became a matter of concern to the civil and religious authorities of the Vice-Royalty of Peru, and in due course was brought to the attention of the King of Spain, who promulgated laws to restrict the cultivation and use of coca and to protect the health of the Indians. The first law was promulgated in October 1569 and, as a protection to the Indians themselves, prohibited the use of coca, entrusting the Church with the task of ensuring the implementation of the law in all matters regarding "superstitions, witchcraft, ceremonies and other evil and depraved purposes".

In another law, dated 11 June 1573, Philip II referred again to the matter, limiting the cultivation of coca to such an extent that, although allowed, it was strictly regulated: landowners cultivating coca were given permission to gather no more than 500 baskets. No additional planting could be made without authorization from the Viceroy, who could not in any case authorize the production of more than 500 baskets as previously indicated under penalty of various fines. The law continues by ordering that landowners must give sufficient food to the Indians in their employment and not keep them on any longer than the time specified in their contract. Finally, another law of April 1574, regulates the purchase and sale of coca. There was therefore a body of very strict law the effect of which was to regulate the cultivation of coca and in the end to restrict it, particularly in the territory of the Real Audiencia de Quito, *where the absence of mines forbade the trade in coca; this was allowed to a certain extent in mining areas under the law of 1574 by the following article:*

"Any person purchasing coca from a landowner may neither sell it nor trade in it except to mining undertakings and the settlements where these are established."

Agriculture and the disappearance of coca addiction

In the seventeenth century and the early days of the eighteenth, the progress of agriculture had a considerable influence on the disappearance of coca plantations. An increasingly intensive cultivation of sugar-cane, bananas, sweet potatoes, yucca, carrots, beans, lentils and certain cereals and fruit trees in the Imbabura, Tungurahua, Canar, Azuay and Loja valleys replaced the coca plantations which had suffered from the restrictions, difficulties and prohibitions embodied in the laws promulgated by the Crown. On the high plateaux and the slopes of the Andes where coca was chiefly consumed, agriculture was similarly developed and the waste land gave place to fields of maize, sweet potatoes, wheat, barley, beans, lupin and *quinua*.

The Indian was the chief agent in this rebirth of agriculture and to a small extent he shared in the harvests. He was forced to cultivate his *guasipungo* (plot of ground adjacent to an Indian's hut and cultivated by him) to feed his family. In the country as a whole, the development of agriculture and stock-breeding resulted in an improvement in conditions for the native inhabitants, who began to carry to their work and on their long or short journeys fibre baskets containing sweet potatoes, cooked beans, maize, baked barley flour, peppers, etc. and to forget the *llipta* and the coca which daily became more expensive and difficult to obtain. The Ecuadorean Indians, particularly those in the hill regions, acquired the habit of quenching their thirst and satisfying their hunger not with expensive coca leaves which gave an illusion of satisfaction but with their baskets of food, their *pilchi* (gourd of water or *chicha)*, an age-long eating habit of the Indian was thus changed and the coca leaf which in former times he had carried hanging from his belt, gave place to the basket of food without which he is today rarely seen.

Jorge Juan and Antonio de Ulloa, in a work entitled *De la fertilidad del territorio de Quito; alimentos comunes de sus moradores; sus especies, y abundancia en todos tiempos* give a detailed and laudatory description of the development of agriculture and the wealth of food products in the *Real Audiencia de Quito*. With reference to the properties of *chicha,* they make this interesting comment: "It is a valuable food and Indians who have no other foods but this drink, with baked maize flour, boiled maize and baked barley flour are vigorous, muscular and of sound constitution." Modern dietetic science has discovered the great food value of the *quinua,* lupin, beans and lentils, maize and other

Indian food products, which explains the energy, vitality and longevity of the Ecuadorean Indian.

The use of coca was at first considered by the civil authorities, certain religious communities and particularly by the missionaries as a diabolical and pernicious custom; this consideration led the authorities to petition King Philip II to prohibit the cultivation and consumption of the plant, as is clear from the law of 1569. The combined activities of the civil and religious authorities and the campaign undertaken by the missionaries against the use of coca without doubt contributed to the disappearance of the coca-leaf chewing habit amongst the various indigenous groups of Ecuador. Proof of the work done in this connexion by the civil and religious authorities can be found in the account of Loja produced in 1571 and 1572, and sent to Ovando by Salinas Loyola. The original of this document is now in the *Real Academia de Historia de Madrid*. This curious document, referring to the customs of the *Paltas* and *Malacatos* Indians of the province of Loja: "They also have *guacas* or idols to which they offer gold and silver and all their possessions, particularly a herb called coca, held by them in great esteem. They do this in secret because they have been told that it is an offence to God to worship such creatures and they are afraid of punishment."

This campaign, acting in conjunction with the various factors which helped to bring about the disappearance of the coca plantations and the elimination of the habit of chewing, must have been vigorous and systematic, since by the beginning of the eighteenth century, there were no longer any coca plantations in the *Real Audiencia de Quito* and the practice of coca-leaf chewing had died out.

Antonio de Ulloa, in a comparative study of the use of coca and betel nut, makes the following comment: "It is exactly similar to the betel-nut used by the people of India, the plant, the leaf, the manner of use and the properties are all the same and the people of India are no less strongly addicted to the betel-nut than the Indians of Peru to their coca, but in other parts of the province of Quito the plant is not used and is unknown." Antonio de Ulloa was one of the few Europeans of the eighteenth century with any knowledge of the customs and the economic and social condition of the Indians of Peru and of the *Real Audiencia de Quito*. It is enough to read his interesting works, particularly his *Noticias Americanas* and his *Noticias Secretas de América* to realize the enthusiasm which this Spanish scholar displayed in acquiring his real and profound knowledge of this ethnic group, the most numerous and the most unfortunate in the Colony.

As Ulloa's authoritative words reveal, coca was neither known nor used by the Indians of Ecuador in the middle of the eighteenth century, although among the Indians of the neighbouring countries to north and south the cultivation and consumption of this plant persisted and was even on the increase. It is thus about two centuries and a half since the Indians of Ecuador, particularly those of the high plateaux, completely abandoned coca-leaf chewing.

The author goes on to deal with the harmful effects of coca addiction according to the Bolivian professor Dr. Juan Manuel Balcázar, and to Dr. Carlos Gutiérrez Noriega and Dr. Vicente Zapata Ortiz, of the Faculty of Medicine in Lima. These authorities state that not only is there no proof that the use of coca strengthens the resistance of the organism, but on the contrary it appears that coca-leaf chewers are subject to chronic derangement of the intelligence, memory and personality. The author also quotes Dr. Jorge Bejarano of the University of Bogotá, according to whom coca addiction causes physical and moral degeneration and at the same time, through heredity, affects the race as a whole.

Physical condition of the Ecuadorean Indian

It may be wondered whether the disappearance of coca addiction in Ecuador has produced better physical development amongst the Indians during these two and a half centuries. The results of the abolition of coca addiction should be studied from two angles, the biological and the social, although, scientifically speaking, the latter should be subordinate to the former. Anthropology is called to the task of establishing the differences in physical and spiritual development between the Indians of Ecuador and those of Colombia, Peru and Bolivia. In order to do so it must study the indigenous groups of the high plateaux in these countries, all of whom were addicted to coca before the eighteenth century, and who are subject to the same biological and geographical conditions. Williams Bollaert in 1860 made anthropological studies of certain indigenous groups in Bolivia, Ecuador and Peru; George Rouma made similar studies in Bolivia and Paul Topinard in 1879 made an anthropometric investigation of certain indigenous types in several countries of South America. Sporadic studies of the same type have been made in Peru by Ales Hrdlicka, Alberto Hurtado, Alberto Guzmán, Julio Pretto, Máximo Kuczinsky, etc. Paul Rivet, Antonio Santiana, Aníbal Buitrón, José Cruz and the author of this article have studied Ecuador. These studies provide an idea of the physical development of the Indians addicted to coca and those not so addicted; but it would be extremely interesting to make a study in accordance with the anthropometric principles proposed by R. Martin and the International Convention of Monaco, and recommended by the Second Inter-American Congress on Indigenous Studies, in order to reach conclusions

permitting comparisons and approximating to the truth. It would very probably appear from such work that the physical development of Indians not addicted to the consumption of coca was better. As I have always realized, the Indians of Imbabura, Loja and other districts of the high Ecuadorean plateaux are better physically developed than those of the high Peruvian plateaux. The physical development of many indigenous groups in Ecuador is marked by a slender figure and a handsome face and it is not unusual to find Indian women, particularly in the province of Imbabura, who are extremely beautiful, although it is true that many of them have a considerable amount of Spanish blood.

The physical strength of the Ecuadorean Indian is undeniable; without the stimulus of coca, he works untiringly either in agriculture, the textile industry or in trade, makes journeys and energetically climbs the steep slopes of the Andes; he endures sleeplessness, rain, wind and the glacial cold of the high mountains without ill-effects to his health. Moisés Sáenz the distinguished expert in indigenous matters, was not exaggerating when he said that "the Ecuadorean Indian is physically strong, vigorous and well made and appears to suffer from fewer diseases than his brethren of other countries"; and it must not be imagined that his clothing helps him to endure the inclement conditions of his environment or that his diet is well-balanced.

Leonardo Chiriboga, referring to the strength of the Indian, makes this rather unfair criticism: "The Indian, despite his apparent muscular power of carrying loads has in reality very little physiological capacity particularly as regards the efficient functioning of the major organic systems of circulation and respiration", and adds: "The strongest proof of this statement is to be found in one of the most obvious characteristics of the Indian: he always works slowly, with frequent pauses and following a monotonous and unchanging routine. Seldom or never is he seen to run, to jump, to become excited, to make rapid, violent or energetic movements or to obey a nervous impulse. The influence of this physiological condition is seen in his music, his dances and his songs: hence the dreary monotony of all his cultural creations. The reciprocal effect of physiology on the spirit, and vice versa, is the final reason for the unhealthy indolence in which the Indian drags out his life."

Chiriboga also concludes that the Indian in all his actions seeks to save energy. I agree that the Indian is less active than the half-caste, and the white man, but I do not agree with the statement that he is less vigorous; in the long run the output of the Indian is as great as that of the white man, even with his saving of energy. The tempo at which he works is closely bound up with his character, his degree of culture and his economic aspirations. But we are not seeking here to compare him with the half-caste or with the white man, but with his congeners of Peru and Bolivia who are addicted to chewing coca.

As regards hygienic conditions, I sincerely believe that there are few groups of Indians in South America so progressive as the Indians of Imbabura and Loja in Ecuador. The cleanliness of their persons and clothing, their confidence in the preventive work of the health service, the changes in their dwellings, etc. show how concerned they are to preserve their health; their clean bright clothes make a favourable impression on tourists and scholars visiting these regions. In this respect, there is an enormous difference between them and the Indians of the high plateaux of Peru and Bolivia.

If the Indians of Ecuador were free from alcoholism and the toxic and degrading effect of their passion for *chicha*, which they have in common with the Indians of Bolivia and Peru, their biological and social progress would be still greater.

In the Ecuadorean hill regions infectious and parasitic diseases are more common than deficiency diseases and cause the highest death rate. The Indians of the eastern and western provinces are subject to tropical diseases which cause their degeneration and decline. If the health authorities could extend their activities to all the Indians in the country, the rural areas of Ecuador would soon begin to be peopled again with the same indigenous inhabitants as in the days before Columbus.

The cultural standards attained by certain groups of Indians in Ecuador, the chief amongst them being those of Otavalo, is undoubtedly superior to those of similar groups in Peru, Colombia and Bolivia. A favourable view of the intellectual development of the Indians of Imbabura is inspired by their interest in the education of their children, the advancement of their customs, the improvement of their industries, the development of domestic and foreign trade, and their interest in sport and the legal and sociological improvement of their trade organization, and their efforts to absorb the white man's culture. Many entirely impartial sociologists who studied the indigenous groups of the high plateaux of Colombia, Peru, Bolivia and Ecuador would not hesitate to admit the cultural superiority of the Ecuadorean Indian. It is logical to suppose that the biological and spiritual development of the Ecuadorean Indian is the result of diverse factors which it would be interesting to study; there can be no doubt that the disappearance of coca addiction is one of those factors.

The Problem of the Chewing of the Coca Leaf in Peru

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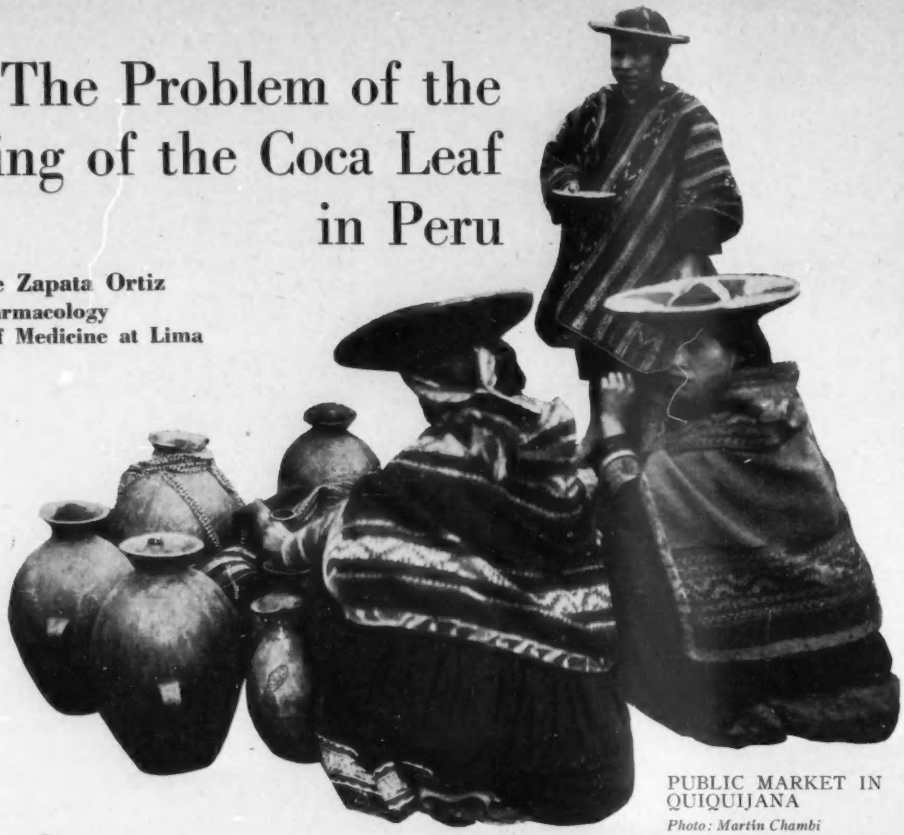


PUBLIC MARKET IN QUIQUIJANA
Photo: Martín Chambi

It has been demonstrated historically and archaeologically that *coquéo, cocaísmo* or the habit of chewing coca leaves existed in a very restricted form in ancient Peru.[1,2] The use of coca was allowed only to the upper classes of society on the occasion of special ceremonies. Coca was regarded as a divine plant and was one of the most important accessories of religion.

The increase in the production and consumption of coca started with the Conquest; and more than 8,500 tons are now produced in Peru every year. This enormous quantity of coca contains over 42,500 kilogrammes of cocaine, of which at least 35,000 are consumed in the process of chewing.

Chewing became general immediately after the Conquest under the influence of various factors, the chief of which are the following: (1) the considerable decline in the production of foodstuffs, (2) the institution of forced labour, (3) the large profits derived from the trade in coca, and (4) the feeling of contentment and artificial well-being which the chewing of the coca leaf produces, and which helped to relieve the hardships of the Conquest and subjugation.

The consumption of coca is not at a uniform level throughout Peru. In the southern sierra over 5,000 tons are consumed annually, in the northern sierra from 2,000 to 2,500 tons, and in the coastal and forest areas only from 1,000 to 1,500 tons.

The quantity of coca chewed daily by the addicts varies between 20 and 60 grammes, with isolated cases of a consumption of more than 200 grammes. Research at the *Instituto de Farmacología y Terapéutica* of the Lima Faculty of Medicine has shown that during chewing an average of 86 per cent of the alkaloids contained in the coca leaves are ingested, the remaining 14 per cent being left in the residue of mastication, which the coca addicts throw away because they derive no stimulus from chewing it. Since these persons divide the daily dose of coca into three or four portions, they ingest between 60 and 80 milligrammes of cocaine each time, or between 160 and 200 milligrammes every twenty-four hours.[3,4,5]

The coca addicts usually masticate the coca leaf with the addition of alkaline substances, sometimes quicklime and sometimes the ashes of various vegetable products prepared in the form of pellets or small cakes containing potassium, sodium, calcium, magnesium, phosphorus and traces of iron and antimony. The pH content of the solutions of these alkalins varies between 10.6 and 11.4.[6] These substances are used because alkalinity helps extraction of the alkaloids, facilitates their absorption by the digestive tract and strengthens their stimulating effect on the nerves.

Absorption and elimination of coca alkaloids

During chewing, the cocaine is ingested in its basic form and is transformed in the stomach into the hydrochloride. The alkaline substances which are ingested at the same time hinder this transformation by neutralizing the hydrochloric acid in the stomach, thus enabling more of the alkaloids to be absorbed at the level of the intestinal tract. This is shown by the rapid appearance of physiological changes in cases where chewing is practised with the addition of alkalins, as compared with the retarded or feeble change or the absence of change which is characteristic when alkalins are not employed, or when, on the contrary, acid substances are used. [4 8 23]

It is still not known what happens within the organism to the cocaine absorbed during chewing, although its presence has been observed in the blood. It is thought that the cocaine is largely hydrolyzed in the liver and transformed into ecgonine, an alkaloid which also has toxic effects. In any case, the excretion of part of the cocaine in the urine is observable even forty-eight hours after chewing, an interval in which from 24.7 to 98.4 per cent of the total alkaloids ingested are eliminated.[5] The elimination of cocaine alone is not so great, varying between 6.7 and 20.8 of the amount ingested, probably because it has been partly transformed into ecgonine and eliminated in that form.

The alkaline substances which are absorbed during chewing play an important part in the elimination of coca alkaloids in the urine. It has been shown in the case of persons who are not addicts that when alkalins are not used from 10 to 20 per cent of the alkaloids are eliminated through the urine in the first six hours following chewing, as compared with from 21 to 34 per cent when chewing is performed with the addition of alkaline substances.[7]

It has also been shown that the excretion of cocaine through the urine is greater in the case of non-addicts in the coastal districts. The probability is that in coca-leaf addicts more of the cocaine molecules are disintegrated. In both non-addicts and addicts, however, the maximum elimination of cocaine takes place during the first hour following chewing.

The great variations from person to person in the proportion of coca alkaloids eliminated through the urine are the result of individual variations in clearance, plasma concentration, indices of histo-plasmatic concentration, capacity for hepatic detoxification, absorptive capacity of the digestive tract and size of the doses ingested.

The elimination of cocaine and other coca alkaloids through the urine shows that they are absorbed by the digestive tract and justifies the inference that they are present in the blood. In this connexion, it is well to explain that although the presence of cocaine in the blood is a point of some importance, it is not the immediate factor in inducing a toxic condition, for such a condition is determined by impregnation of the tissues, particularly of the nervous system, the liver and other organs. The part played by the alkaline substances at this histic stage has still not been determined, although it is thought that such substances increase the stimulating effect of cocaine on the nerves, a view which is supported by the following facts: (1) cocaine in its basic form is most soluble in fats, and the nervous system is largely composed of fats; (2) basic cocaine is charged with positive electricity, its micelles or ions being absorbed by the negative charges in the nervous system; (3) the potassium salts contained in the alkaline substances employed with chewing facilitate the penetration of basic cocaine into the nervous tissue by increasing the permeability of the lipoid layer to water; and (4) the alkaline substances, in producing a non-acid pH, prevent the hydrolysis of the cocaine and facilitate its action.[4 23]

Formation of the coca habit

Coca addicts usually begin to form the habit after leaving school, between the ages of 12 and 14.

It should be said that in spite of the marked differences between the coca-chewing habit and cocaine addiction, they have nevertheless certain points in common. In both cases cocaine is responsible for the principal effects.

It has been shown that the ease and intensity with which addiction to a drug is established largely depends on the method of administration adopted, the intravenous method being most effective, with the subcutaneous and oral methods coming next in order. In coca-leaf chewers, the cocaine penetrates the organism by this last means and in doses smaller than those used by cocaine addicts. It is for this reason that coca chewing is not accompanied by the startling toxic features so frequent among those addicted to cocaine, and that its effects are much slower and essentially chronic. The symptoms of addiction to cocaine are therefore relatively weak, a circumstance which enables the individual concerned to give up the drug with ease.

Difficulties are encountered and moderate abstinence symptoms appear only in the case of coca addicts who consume more than 100 or 200 grammes of coca a day.

The cocaine habit starts much more easily, as has been experimentally demonstrated with dogs. The first to produce experimental addiction to cocaine were Tatum and Seevers.[24] Somewhat later Gutiérrez Noriega and his collaborators confirmed and extended the knowledge of this phenomenon.[12] The craving for the drug is so marked in habituated dogs that even when they have not been fed for a long time they refuse food in order to obtain an injection of cocaine, and can endure painful electric shocks provided they obtain the drug. It has also been shown in the case of these animals that cocaine does not induce tolerance, but, on the contrary, phenomena of increased sensitivity. Thus, during a course of treatment with cocaine, it is almost impossible to increase the initial dose; and on the contrary, as the experiment proceeds, the reactions produced by the same dose of cocaine become stronger until the day arrives when marked toxic phenomena are displayed and may result in the animal's death. We have called this phenomenon increased sensitivity as opposed to tolerance, which is a characteristic of morphine, a drug the doses of which must be increased in order to obtain effects equal to those produced by the small initial dose. Tolerance of cocaine does not occur in human beings either, and most coca addicts take practically the same dose of coca throughout their lives.

Effects of coca

The effects of coca on the individual are various, but among them may be distinguished physiological and psychological effects, both acute and chronic.

The acute physiological manifestations are not of great importance and are characterized by tachycardia, a slight increase in arterial pressure and body temperature, a somewhat accelerated respiratory movement, the intensification of tendinous reflexes, modification of the neuro-vegetal reflexes, increased basal metabolism and delayed reaction to auditory stimuli.[8 14 18 26] In addition, coca and cocaine increase the resistance to fatigue.[11] This last point deserves special consideration, because it must not lead to the conclusion that coca has a beneficial effect on the output of human labour. The chronic effects of addiction to coca and malnutrition among the chewers lead to a general weakening of the system, and consequently the stimulating effect of coca hardly ever produces in the chewer an output of labour greater than that to be observed in persons not addicted to the drug but receiving proper food.

Studies now being conducted by Dr. Santiago Valdizán and to be published shortly in their entirety show that coca addicts, even when under the stimulating influence of coca, display, together with a reduced liability to fatigue, a lower output of physical labour as compared with persons who are not habituated.

Dr. Valdizán used the "Whipple tapping test" which consists of ascertaining the number of taps which the person being tested can make with a punch on a metal plate within a given period of time. The number of taps is recorded by means of an electric register in periods of twenty seconds for a total duration of two minutes, and the total thus obtained constitutes the output of the person being tested. Comparison of the values obtained for the six periods of twenty seconds establishes the extent to which the person being tested is subject to fatigue.

Valdizán tested 500 coca addicts and 500 non-addicts and he found that the *output of the latter (the non-coca addicts) was greater,* the average varying between 127.6 for the first twenty seconds and 102.5 for the last twenty seconds; while in the case of the coca addicts these averages were no more than 108.6 and 94.7 respectively. As may be seen, the difference in output for the first and last periods of twenty seconds is 25.1 in the case of non-addicts and 13.9 in the case of the coca addicts. This indicates a lesser inclination to fatigue among the latter *while they are under the stimulating influence of the drug.*

Observations made by the author in the Sierra with the Smedley dynamometer show that the average strength values of the coca addicts varied between 28 and 32 kilogrammetres, while similar experiments conducted with Lima medical students yielded average values of between 40 and 45 kilogrammetres. If we remember that in the case of the chewers the experiment was conducted while they were under the stimulating influence of coca and that they were persons who by reason of their occupation should have been better capable of muscular effort, we are surprised by the low indices obtained as compared with those for the group of students, who, apart from not being under the influence of any drug, were persons whose work was essentially intellectual. As we shall see, the difference is due principally to the fact that the student group was well nourished while the chewers lived on diets deficient both as to quality and quantity.

So far as concerns the chronic physiopathological manifestations (including not only those acquired during the individual's lifetime but also inherited ones), it is very difficult to say exactly to what extent they are the exclusive result of coca chewing. The difficulty of defining them is increased by the effects of alcoholism, under-nourishment and the generally unsatisfactory health conditions under which the coca addicts lived. In any case, the ill-health of the chewers is an easily demonstrable fact, for many of them have chronic diseases, and some show signs of degeneration.[14]

Everything points to the conclusion that the constant toxic condition produced by coca results in acceptance of the most wretched living conditions, which are the chief cause of the chewers' deficiencies; and coca is therefore regarded as primarily responsible.

No less important than the physiological changes are the psychological modifications which coca produces. The acute effects on mental activity are various. Large doses of coca produce changes in thinking, effectiveness, perception, etc. The chronic psychological changes are those which are of greatest interest and to which particular attention has been devoted. Under the able direction of the late Professor Carlos Gutiérrez Noriega, we made a comprehensive study of this subject, which embraces the intelligence, powers of attention and personality of the chewers.[19]

The intelligence rating as determinated by the Binet-Simon test shows very low indices not exceeding 90 per cent. In most cases the indices are between 50 and 70 per cent.

In order to eliminate possible errors arising from any misunderstanding of the questions which might be caused by the fact that many of the cocaine addicts have an insufficient knowledge of Spanish, an interpreter was always available. For the same reason, use was made of the "non-language multimental test of Terman, McCall and Lorge", and the Porteus labyrinth test, because these are tests in which words are not employed. The results obtained from the Terman test were discouraging and apparently contradictory. The intelligence coefficients were much lower than those obtained from the Binet-Simon test. We attribute these results to the fact that the Terman test consists of series of shapes the selection of which requires the exercise of abstract thought more often than in the case of the other tests. In this kind of mental ability the coca addicts display a marked deficiency. Though still sub-normal, the results yielded by the Porteus labyrinth test were somewhat better than those obtained from the Binet-Simon test. In addition, use was made of the Rorschach test which confirmed the results obtained from the other tests.

A very interesting and revealing phenomenon is disclosed by an examination of intelligence coefficients and the length of addiction to coca. There is a close relation between these factors, the duration of addiction being in direct ratio to the mental age and vice versa, a circumstance which clearly shows the important part played by coca in the process of mental deterioration displayed by coca addicts. Mental deficiencies begin as soon as addiction to coca starts, and increase as addiction continues. According to information supplied by schoolmasters in the sierra, the mental development of children who are addicted to coca shows a backwardness which can almost be made good when the chewing habit is overcome.

It is undeniable that other factors may have an adverse effect on mental development, such as education, language, geographic and social isolation, economic hardship, heredity, alcoholism, nutritional deficiencies, etc. In a previous publication we studied in detail the part played by each of these factors in the coca addict's mental backwardness, and we believe that those factors are of secondary importance.[15] The relation between the duration of addiction to the drug and mental deterioration shows that coca is the chief cause of the deficiencies encountered. It is probably true to say that coca is in turn responsible for some of the factors mentioned above, and that in this way it acts on the intelligence both directly and indirectly.

Also revealing are the relations between the duration of addiction to coca on the one hand, and illiteracy and resistance to learning Spanish on the other hand. Thus, persons who have been addicted to coca for many years are almost all illiterate and the language they speak is predominantly the vernacular. In the departments of the southern sierra, where the consumption of coca is greatest, the percentage of illiteracy is high, and Quechua and Aymara are the prevailing languages.

Coca also has an adverse effect on the power of concentration. As determined by the Hamburgo test, the power of concentration among coca addicts bears a relationship to the duration of addiction to coca, the power of concentration being less among inveterate coca addicts than among those who have been addicted for only a short time.

The personality of coca addicts was studied by means of the Rorschach test, and it was found that the neutral type predominated at any rate amongst inveterate chewers. Such addicts are apathetic, hypo-affective, indolent, deficient in higher mental activity and subjective life.[19] They are aimless, indifferent and maladjusted. Next in numbers come the egocentric, extratensive types, and in the third place, and forming only a small minority, the introvert types, who significantly have the highest intelligence coefficients and the lowest duration of addiction. It is not claimed, however, that the results obtained from the Rorschach test are the consequence of the coca habit alone. They might be racial in nature or the result of other factors. In any case, coca is not the only drug capable of changing the personality and affecting the results obtained by the Rorschach test.

It has been shown that extroversion is prevalent among the less serious cases of chronic alcoholism, whereas among the most extreme cases the degree of extroversion is reduced.[1 2] The particulars we have mentioned suggest that chronic alcoholism produces modifications in the personality and in the results obtained by the Rorschach test. From the theoretical point of view there is no objection to accepting the thesis that a change in personality also takes place in

coca-leaf chewers owing to the chronically toxic effects which coca produces.

Coca addiction and nutrition

This is the most important aspect of the problem we are studying.

The elimination of the sensation of hunger is one of the characteristic effects of addiction to coca and the most important reason why the inhabitants of the Andes contract the habit.

There is a manifest relation of antagonism between addiction to coca and nutrition. Historical data show that in ancient Peru there was an abundance of food, particularly in the Andean area, which is today the poorest and most badly supplied. The drug, which is used today to counter the effects of hunger and stimulate organisms weakened by undernourishment, then had no purpose to fulfil, and, as has already been said, its use was confined to particular social classes and special occasions. In an extremely interesting study,[17] Gutiérrez Noriega showed that in those parts of Peru where nutrition is most unsatisfactory the consumption of coca is greatest. In the southern sierra where chewing is prevalent and where the average annual consumption of coca per head (including non-chewers) is between two and four kilogrammes, the daily food ration is about 767 grammes. In the northern sierra, where between one and two kilogrammes of coca are consumed annually per head, the food supply is better, although it amounts to only 904 grammes a day. In other areas, where the consumption of coca amounts to only 100 grammes per head annually, the food supply is 1,096 grammes a day.

From the point of view of quality there is the same relation between addiction to coca and nutrition, the diets of poorest quality being found in areas where chewing is most widespread. In general, the average number of calories provided by the amounts of foodstuffs noted is below the normal in all the areas surveyed, but the shortage is most marked in the Southern Andes, which is the area where most coca is consumed and where the diet, besides being almost completely lacking in proteins (meat, milk, eggs) and in fruits and sugar, is very poor in fats, legumes and green vegetables, and consists chiefly of farinaceous foods (wheat, barley, maize, *quinoa*, potatoes, etc.). The 767 grammes of food which the inhabitant of that area receives daily yield no more than about 2,000 calories, a figure which is very much below the minimum needed by a working man. Since coca is absolutely lacking in nutritive or energy-supplying properties, and since there is a large consumption of alcohol in the areas where addiction to coca is most widespread, it is probable that part of the physiological minimum of calories is in some cases supplied by alcohol. This substance is not a food, either, and since it is as toxic and dangerous as cocaine, its toxic effects are added to those of that alkaloid.

The relation between the extent of cocaïsm and dietary deficiencies is very revealing, and we believe that shortage of food is the main reason for the existence of coca addiction, and that any campaign for the suppression of this pernicious habit must be accompanied in the first place by an improvement in the nutrition of the coca-chewing populations. In this connexion we have conducted experiments which, though of brief duration, yielded very significant results. At Huancayo a group of coca addicts were kept under strict observation for a number of days. They were provided with good food, and it was found that they voluntarily gave up coca-chewing as the experiment proceeded and their state of nutrition improved. As has already been said, it has been established as a historical fact that the causes determining the spread of addiction to coca in the Andean area are related to the considerable decline in the production of foodstuffs which occurred immediately after the Conquest.

General considerations on the subject of coca addiction

The problem of the chewing of coca leaves has long been a subject of interest to many students. The general opinion of those who have worked on the subject directly is that coca produces a number of unfavourable effects. There are, however, people who regard coca as of great value to the Indian and who advocate the unrestricted continuation of its use. Let us consider some of the views of those who are of that opinion:

In the first place, it is said that coca is indispensable for the acclimatation of man to great heights, and that if coca leaves are not chewed in many countries in South America it is because those countries do not contain the high altitudes which are to be found in the Peruvian Andes. While it is true that the greatest heights are to be found in Peru and Bolivia, it is also true that other American countries contain population centres situated at high altitudes, and that the coca habit is completely unknown in them. We shall mention a few examples supplied to us by the Department of Geography of the University of Wisconsin (United States of America). In Ecuador there are population centres situated at heights of over 4,000 metres, such as Chuquipoquío to the north-east of Riobamba and the villages of Antisana to the south-east of Quito. In Colombia there are settlements between 3,500 and 4,000 metres above sea level, such as La Argentina to the north-east of the town of Ibague, La Leona (3,640 metres) near the town of Manizales, and Bucaracica to the west of the town of Cúcuta. In Venezuela, on the transandine highway, there is the settlement of Casa de Gobierno north-east of the town of Mérida at

an altitude of approximately 4,000 metres, and the village of La Culata at an altitude of 4,487 metres about 20 kilometres to the north of the same town of Mérida. In Mexico, approximately 100 kilometres north of the capital in the central part of the country, there are many villages between 3,000 and 3,300 metres high (San Joaquín, Yonderé, La Purísima, Palizada, Pundereje, etc.). It is true that the places referred to do not have large populations, but it is undeniable that these references demonstrate the possibility of living at heights of 4,000 metres or more without using coca. Why do the indigenous inhabitants of Peru need coca at altitudes of 3,000 or 4,000 metres when the inhabitants of other countries do not? Furthermore, not all the inhabitants of the Peruvian Andes consume coca. It is generally known that the inhabitants of the coastal areas easily adapt themselves to life on the high plateau without the need for coca, and that the same is true of persons with other countries of origin, many of them Europeans or North Americans, who have established themselves with their families near the highest mines and in the highest cities of Peru, where they live and procreate children without the least difficulty and consequently without the need for coca to help them to adjust themselves. And even in the Andean native villages themselves, the consumption of coca among women is insignificant.

We might multiply examples contradicting the contention of those who maintain that coca is necessary for life at high altitudes, but we shall confine ourselves to mentioning one or two more. Angel Giménez[10] observes that in the copper mine in the central Navarro area (Mendoza, Argentina), 4,500 metres above sea level, the workers do hard manual labour and are perfectly adjusted to the height without the need for coca or other toxic drugs, but that they are well fed. In Brazil, addiction to coca also exists, particularly among the Huitotos of the Amazon region[21] less than 300 metres above sea level. In the great uplands of Tibet, which are much higher than the Peruvian Andes, neither coca nor any similar drug is consumed. In India on the other hand there were some coca addicts almost at sea level and more than a million consumers of cocaine.[9]

In our opinion, the consumption of coca is not necessary to life at high altitudes, and as we have already shown, it is closely related to general conditions of life and nutrition and to the individual's facilities for obtaining the drug. A clear example of this is provided by the Peruvian army, which consists of a high percentage of natives of the Andes, who give up coca immediately on commencing their military service; and this is true not only of those soldiers who go down to the coast to do their service, but also of those who remain in quarters on the high plateau. The reason is obvious. They give up coca with the greatest of ease (which proves that it is not necessary), because in the army they get proper food and living conditions. In many estates on the north coast of Peru, on the other hand, where living conditions and nutrition are inadequate, the Andean workers keep on consuming coca.

It is affirmed that the inhabitant of the Andes is a distinct being, physically and chemically; that he forms a whole with the environment in which he lives and to which he is perfectly adapted; that he constitutes a climatic and physiological variety of the human race, etc., and that while other races do not need coca, to the Andean it is indispensable.[20] On this subject we shall merely quote the opinion of Professor Gutiérrez Noriega [16] who says: "It is maintained that the acclimatized Andeans are a true 'climato-physiological racial variety'. This means that the process of adaptation has reached such an extreme of perfection that it transforms the human being into a new race. In these circumstances it is clearly illogical to require the assistance of an alkaloid in order to achieve acclimatization. Is the subject of discussion, therefore, a race which has become adapted to the climate, or a pharmacological process which results in adaptation to the climate? If the inhabitant is so well acclimatized that he has become racially transformed by acclimatation, drugs to assist adaptation should not be necessary. The inconsistency is even greater if we recall that the Spanish white race and other races which have adapted themselves to the climate of the Andes in recent years do not use coca for the purposes of acclimatization. Hence it seems to me absurd to assert that the 'climato-physiological race', whose inhabitation of the Andes goes back for thousands of years, requires coca alkaloids to enable it to live at great heights, while races which are of much more recent settlement and which should theoretically be less well adapted do not need the drug."

Another argument in support of coca is based on its allegedly stimulating effect on muscular labour. In this connexion reference is made to experiments carried out at great heights on persons who, when under the effects of coca, have exerted a muscular effort greater than that of the inhabitants of the plains. In this connexion it is enough to recall that the effect of cocaine on the output of labour and the ability of cocaine to strengthen certain humoral reactions which tend to raise that output are perfectly well-established facts; and although it is true that the chewing of coca leaf diminishes fatigue and by exerting a stimulating effect may increase the output of work within the short period of a particular experiment, this result in no way shows that coca addicts are capable of doing more work and achieving a greater output over the protracted period required for their customary tasks, and much less that they have a greater capacity for labour than persons who do not consume coca and who receive proper nourishment.

As an example to show that coca improves the output of labour, reference is made to the ancient Peruvians' monumental achievements in stone and it is affirmed that their execution was possible only owing to the invigorating effect of coca. But in that case, it may well be asked why the Indian does not produce works on anything like so vast a scale today, when the consumption of coca is much greater.

It is also asserted that the concentrations of cocaine in the blood of addicts are very small and do not exceed half a microgramme per cubic centimetre, and that such insignificant quantities of the drug are not capable of producing toxic effects. How can it be stated, however, that a concentration of half a microgramme or any other amount has no toxic effects if the concentrations which are really toxic, and which must be known if a comparison is to be made, have not been established? In this respect it should be recalled that the most recent publications of M. H. Seevers and his group[25] in the Department of Pharmacology of the University of Michigan show among other conclusions that in the blood of dogs which were injected with cocaine, concentrations of only 3.3 to 6.9 microgrammes per cubic centimetre were found at the time when convulsions occurred; that cocaine has a greater affinity for the tissues than for the blood; and that the central nervous system, particularly the cortex of the brain, shows the greatest concentrations of the drug.

In view of the fact that dogs are animals much more resistant than man to the effects of cocaine and many other drugs; that Seevers' experiments are occasional and not of equal duration with chronic addiction to coca; and that nevertheless concentrations of 3.3 microgrammes of cocaine per cubic centimetre are enough to produce convulsions, can the concentrations of 0.5 microgrammes of cocaine per cubic centimetre which it is affirmed that coca addicts display be regarded as harmless and insignificant, especially if it is borne in mind that these concentrations are repeated several times a day throughout life?

It is also affirmed that the effects of addiction to coca do not altogether fit in with the definition of drug addiction given by the World Health Organization.[22]

If before the existence of addiction and the pernicious effects of the use of a particular drug could be recognized, it were necessary to establish the characteristics of compulsion, progressive increase in dose and mental and physiological dependence on the drug's effects, there would be no reason to combat cocaine addiction; for in the first place it has been experimentally demonstrated that cocaine (the most important alkaloid in the coca leaves consumed by the inhabitants of the Andes) does not produce tolerance, but the very opposite, increased sensitivity;[12 24] secondly, there are no cocaine addicts who can appreciably increase the dose of cocaine with which they started; and lastly, such addicts do not display physiological dependence on the drug and can give it up at any time without exhibiting such abstinence symptoms. In spite of these facts, no one attempts to deny the harmful effects of cocaine. Why should coca addiction be required to fulfil conditions that are not satisfied in the case of cocaine addiction? We do not say that all persons who chew coca are drug addicts, but we have observed many such persons who cannot be described otherwise. In this connexion it should be recalled (W. W. Adams, *Drug Addiction*, Oxford University Press, 1937) that addictions to drugs display a great variety of symptomatic manifestations and that between the addict who is perfectly adapted to society and whose state passes unnoticed and the addict who has to be shut up by force in an asylum there are all conceivable intermediate stages.

In the case of addiction to coca, what is really important are the effects which it produces, whether it be a typical case of addiction to drugs or not, and if people insist on regarding it as a habit, it should at any rate be made clear that it is a harmful habit.

Economic arguments have also been advanced and it has been urged that the revenue produced by the cultivation of and trade in coca is so great that their suppression would upset the national economy. That is by no means certain, however, as may be seen from the data supplied by the Ministry of Finance and Commerce to the United Nations Commission which came to Peru and Bolivia to study that problem. Those data showed that the revenue from taxes on coca which it was expected to obtain in 1950 amounted to only 0.23 per cent of the general budget estimates for the Republic.[22]

We are convinced that the suppression of the coca plantations would enable the land now used for the growing of coca to be exploited for crops which are economically more productive and of benefit to the public. In this connexion it has been demonstrated that this land would produce very good crops of maize, fruit, yuccas, sweet potatoes, tea, cocoa and many other foodstuffs.

Rough estimates indicate that in Peru there are at least 17,000 hectares of land used exclusively for the cultivation of coca and not more than 21,000 hectares used for growing vegetables. The area used for the production of coca is probably greater, since there are plantations whose situation in the mountains makes inspection very difficult and sometimes impossible.[17]

And even if it were true that the economic benefits to the State contributed by coca were considerable, it

would still be unreasonable to tolerate addiction to coca, which impairs the physical and mental health of the people.

Lastly, we have shown that the cocaine contained in the coca leaves is absorbed during chewing. Proof of that is to be found in the portion eliminated through the urine. The effects of addiction to coca are due principally to the effects of cocaine. As we said at the beginning, official data show that more than 8,500 tons of coca leaves are consumed annually in Peru, and that these leaves contain more than 42,500 kilogrammes of cocaine, of which at least 35,000 kilogrammes are consumed during chewing. It is not necessary to be an expert in drug addiction to understand the enormous harm caused by the ingestion of such gigantic quantities of a drug which is both toxic and dangerous.

BIBLIOGRAPHY

[1] O. Billing and D. J. Sullivan: Prognostic data in chronic alcoholism, *Rorschach Res. Exch.* v. 6, p. 117, 1942.

[2] O. Billing and D. J. Sullivan: Personality structure and prognosis of alcohol addiction: a Rorschach study, *Quart. Journ. of Studies of Alcohol*, v. 3, p. 554, 1943.

[3] Emilio Ciuffardi: Dosis de alcaloides que ingieren los habituados a la coca, *Revista de Farmacología y Medicina Experimental*, T. 1, pp. 81 and 216, 1948.

[4] Emilio Ciuffardi: Contribución a la química del cocaísmo, *Revista de Farmacología y Medicina Experimental*, T. 2, p. 18, 1949.

[5] Emilio Ciuffardi: Publicación en prensa en la *Revista de la Sanidad de Policía*, Año 11, No. 67, 1951.

[6] G. Cruz Sánchez and Angel Guillén: Estudio químico de las substancias auxiliares al cocaísmo, *Revista de Farmacología y Medicina Experimental*, T. 1, p. 209, 1948.

[7] G. Cruz Sánchez and Angel Guillén: Eliminación de la cocaína en sujetos no habituados, *Revista de Farmacología y Medicina Experimental*, T. 2, p. 8, 1949.

[8] N. Chamochumbi: Efectos de la coca sobre el metabolismo basal en sujetos no habituados, *Revista de Farmacología y Medicina Experimental*, T. 2, p. 94, 1949.

[9] Chopra and Chopra: *Indian Journal of Medical Research*, v. 18, p. 1013, 1913.

[10] Angel Giménez: Sobre la represión del coqueo. Proyecto de Ley, *La Semana Médica*, 41, II, p. 1892, 1934.

[11] C. Gutiérrez Noriega: Acción de la cocaína sobre la resistencia a la fatiga en el perro, *Revista de Medicina Experimental*, v. 3, p. 239, 1944.

[12] C. Gutiérrez Noriega and V. Zapata Ortiz: Cocainismo experimental. I. Toxicología general, acostumbramiento y sensibilización, *Revista de Medicina Experimental*, v. 3, p. 279, 1944.

[13] C. Gutiérrez Noriega: Datos históricos sobre la habituación a la coca en el Perú, *Revista de Medicina Experimental*, v. 3, p. 341, 1944.

[14] C. Gutiérrez Noriega and V. Zapata Ortiz: Observaciones Fisiológicas y Patológicas en sujetos habituados a la coca, *Revista de Farmacología y Medicina Experimental*, T. 1, p. 1, 1948.

[15] C. Gutiérrez Noriega and V. Zapata Ortiz: Estudio de la inteligencia en sujetos habituados a la coca, *Revista de Farmacología y Medicina Experimental*, T. 1, p. 32, 1948.

[16] C. Gutiérrez Noriega: Errores sobre la interpretación del cocaísmo en las grandes alturas, *Revista de Farmacología y Medicina Experimental*, T. 1, p. 100, 1948.

[17] C. Gutiérrez Noriega: El cocaísmo y la alimentación en el Perú, *Anales de la Facultad de Medicina*, v. 29, p. 1, 1948.

[18] C. Gutiérrez Noriega and V. Zapata Ortiz: Estudio de los habituados a la coca en estado de abstinencia, *Revista de Farmacología y Medicina Experimental*, T. 3, p. 56, 1950.

[19] C. Gutiérrez Noriega and V. Zapata Ortiz: La inteligencia y la personalidad en los habituados a la coca, *Revista de Neuro-Psiquiatría*, T. XIII, p. 22, 1950.

[20] C. Monge: El problema de la coca en el Perú, *Anales de la Facultad de Medicina*, T. XXIX, p. 311, 1946.

[21] C. P. Murdock: *Our primitive contemporaries*, Cap. XV. New York, 1934.

[22] United Nations. Economic and Social Council. Twelfth session. Special Supplement No. 1. *Report of the Commission of Enquiry on the Coca Leaf*. New York, May 1950.

[23] P. Salomón B.: Potenciación del efecto neuroestimulante de la cocaína por substancias alcalinas, *Revista de Farmacología y Medicina Experimental*, T. 2, p. 114, 1949.

[24] A. L. Tatum and M. H. Seevers: Experimental cocaine addiction, *Journal of Pharmacology and Experimental Therapeutics*, v. 36, p. 401, 1929.

[25] L. A. Woods, F. G. McMahon and M. H. Seevers: Distribution and Metabolism of Cocaine in the dog and rabbit, *Journal of Pharmacology and Experimental Therapeutics*, v. 101, p. 200, 1951.

[26] V. Zapata Ortiz: Modificaciones psicológicas y fisiológicas producidas por la coca y la cocaína en los coqueros, *Revista de Medicina Experimental*, v. 3, p. 132, 1944.

Note on the Total Synthesis of Morphine

By Dr. Ulrich Weiss, D.Sc.

Two review articles in the *Bulletin* [vol. II, no. 2, pp. 8-20 (1950), and vol. III, no. 2, pp. 12-31 (1951)] have attempted to describe the main lines of the chemical research that led in 1925 to the generally-accepted structural formula for morphine (formula XII on the accompanying chart) and it has been tried (on pages 19-24 of the second article) to give a brief résumé of the chemical reactions which have resulted in total syntheses of two different chemical compounds, each of which has been found identical with a transformation product of codeine. Those syntheses had given convincing support to the correctness of formula XII for morphine but final proof by total synthesis had not yet been provided.

It is therefore of the greatest importance that Gates and Tschudi, continuing their earlier synthetic work,[1] have succeeded in performing a total synthesis of morphine. This synthesis is outlined in a short communication in the issue of 20 February 1952, of the *Journal of the American Chemical Society* (vol. 74, page 1109). We feel that the magnitude of this scientific achievement warrants a brief exposé of the sequence of chemical reactions followed, which is represented in the accompanying chart.

This involved series of reactions constitutes a transformation of the synthetic compound I, described earlier,[1] into morphine, and furnishes unequivocal proof for the formula XII for morphine. The lengthy history of the structural elucidation of this base can therefore be considered to have reached the long-expected satisfactory conclusion.

Brief comment on some of the chemistry of this synthesis may seem in order. It will be recalled (cf. the *Bulletin*, vol. III, no. 2, p. 24) that Gates and Tschudi[1] had been able to convert compound I in several steps into the racemate of II, which had been proved by infra-red spectroscopy to have the same chemical constitution as β–dihydrodesoxycodeine, a compound derived from the natural alkaloid in a way which led to inversion of the configuration at carbon atom 14. This "unnatural" configuration is indicated by the prefix β.

The synthetic racemate of II has now been resolved into the optical antipodes, of which the d-form has served as starting material for the subsequent steps, most of which will be clear from the chart. In every step, the intermediates obtained were compared with previously known transformation products of codeine, or with derivatives of the natural alkaloid prepared for this purpose (compounds VI, IX, X); identity was established in every case.

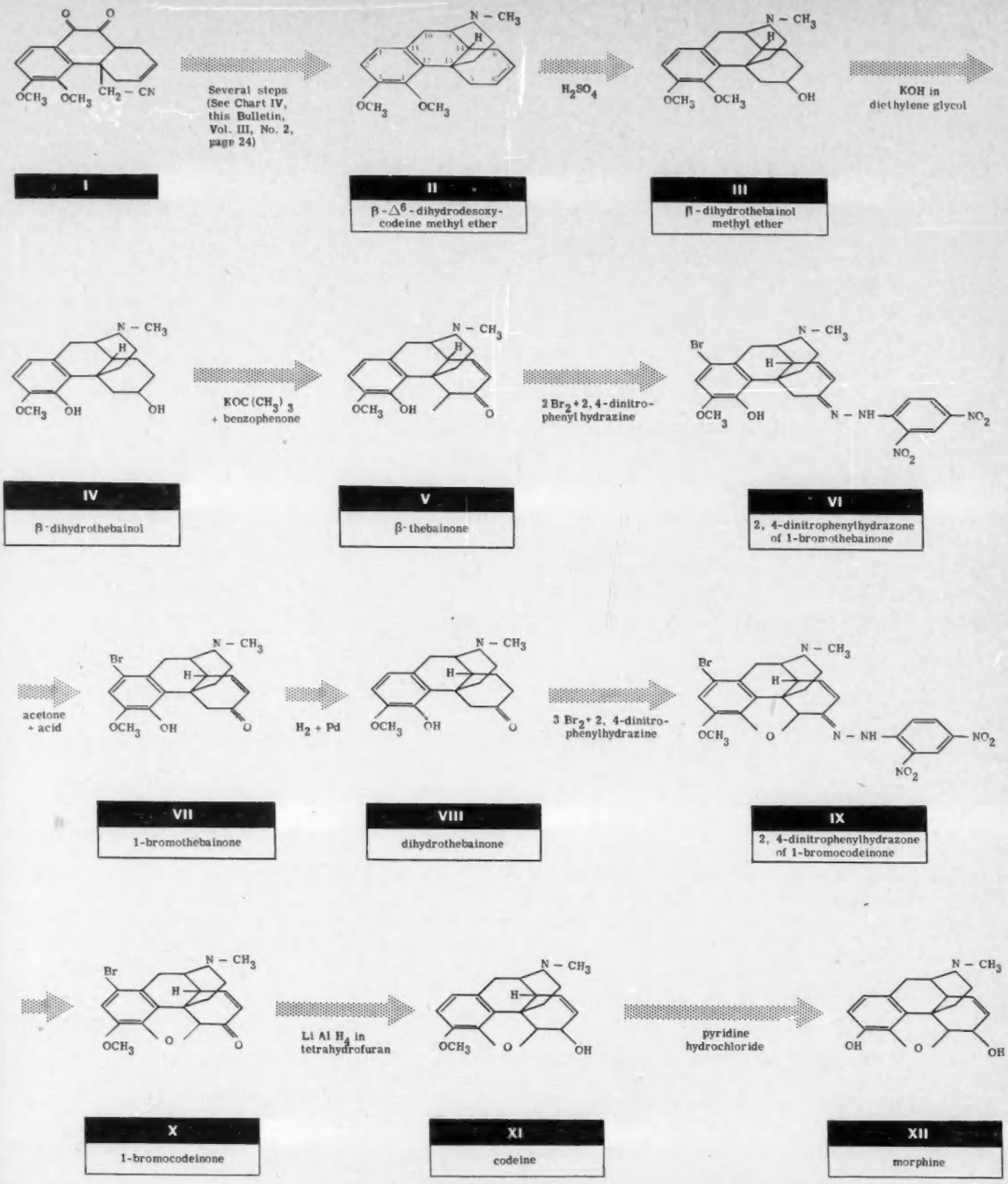
The following individual steps may require comment:

V–VI: Compound V must have been brominated in the 1– and 7– positions, contrary to earlier experience in the codeine-series,[2] where bromination first in I, then in 5 has been generally observed. In the reaction V–VI, HBr must have been eliminated subsequently under the influence of the 2,4–dinitrophenylhydrazine, establishing the desired double bond between C_7 and C_8, a type of reaction much utilized in recent work on steroids. In the present case, however, the configuration at C_{14} has changed simultaneously from the "unnatural" β– type to the one normally present in codeine-derivatives, no doubt through transient shift of the double bond into the 8,14–position. Such shifts have been postulated earlier.[3]

VIII–IX: This reaction is analogous to the one just discussed, except for the closure of the oxygen bridge, which is generally observed on bromination of codeine-derivatives in the 5–position and subsequent action of base.[2]

XI–XII: The demethylation of codeine to morphine with pyridine–HCl has recently been described for the first time by Rapoport, Lovell and Tolbert.[4] This reaction permits the transformation of the synthetic codeine into morphine itself.

Several of the reactions of this synthesis proceed with low yields or result in mixtures (II–IV, VIII–IX, IX–X); even without this fact, the large number of steps required would seem to make any practical utilization of this synthesis quite unlikely, which of course does not in any way diminish its scientific importance.



BIBLIOGRAPHY

[1] Gates and Tschudi, *Journ. Amer. Chem. Soc. 72,* 4839 (1950).

[2] Cf., e.g., Schoepf *et al.*, Ann. *483,* 157 (1930), *492,* 213 (1932); Small *et al., Journ. Amer. Chem. Soc. 58,* 1457 (1936).

[3] Cf. Small, *Chemistry of the Opium Alkaloids* (1932), p. 248.

[4] Rapoport, Lovell and Tolbert, *Journ. Amer. Chem. Soc. 73,* 5900 (1951).

OFFICIAL

Legal Trade in Narcotics in 1950

During its fourteenth session the Economic and Social Council, which is meeting in May 1952, will examine the Report of the Permanent Central Opium Board on the task accomplished in 1951.[1] This report presents an over-all picture for 1950 of the production and consumption of narcotics, and of their licit traffic throughout the world, as it shown by the analysis of the statistics submitted to the Board by governments.

The reader will find below the main features exhibited by the Report of the Permanent Central Board.

Present state of control

The Board believes that, if all the facts noted in regard to the control of narcotic drugs since the publication of its last report are considered, some improvement may be discerned. On the credit side, the following points may be noted:

(*a*) Co-operation by several governments in the Board's work has improved;

(*b*) Fourteen narcotic drugs, including twelve synthetics, have been placed under international control during the year 1951, under the provisions of the Protocol of 19 November 1948;

(*c*) A considerable illicit traffic in diacetylmorphine, which had its source in the licit supply of Italy, was discovered; the Italian Government has stated that appropriate action was being taken, and there is ground for hope that this source may presently dry up;

(*d*) The production of crude cocaine in Peru, which is the largest in the world, is now the subject of a State monopoly.

On the debit side, the most important factor remains the inadequacy of control over the production of opium and of coca leaves. Some of the biggest producing countries have never furnished the statistics which would have enabled the Board to supervise the movement of these substances from the time of production.

These defects seriously hamper the functioning of the present organization for the international control of narcotics.

As shown by the reports on "Illicit Transactions and Seizures" published by the United Nations Commission on Narcotic Drugs, one of the consequences of this state of affairs is that opium continues to be the subject of a very considerable illicit traffic; and, given the fact that opium *licitly* exported by producing countries thereafter seldom leaves the licit market, there is ground for the conclusion that the illicit traffic in question has its origin in the producing countries, where much of the opium concerned probably never enters licit "circulation".

The Board is led to believe that the efforts made by governments to remedy this state of affairs, as also to avoid the dangers inherent to the appearance of numerous new narcotic drugs, should in the first place be directed especially towards improving and strengthening national controls.

The situation of the control in Italy has given rise to widespread criticism and anxiety owing to the escape from this country of diacetylmorphine into the illicit traffic. This view of the situation has now been confirmed by the fact that, whereas the stock of this drug in Italy at the end of 1950 should be 306 kilogrammes, the Italian Government reported a stock of only 142 kilogrammes and declared that this disappearance of 164 kilogrammes was in course of investigation in the national territory and in the Free Territory of Trieste.

The Board has had this situation under review and asked the Italian Government that the stocks of diacetylmorphine held by manufacturers and wholesalers should be limited to an amount representing licit requirements for about eighteen months; that any surplus stock should be kept under the direct supervision of the Government; and that no new production should take place until this stock has fallen to the above-mentioned level.

In reply, the Ministry for Foreign Affairs of Italy stated that:

"...the Italian High Commissioner's Office for Hygiene and Public Health does not consider the production of alkaloids in Italy to have been generally excessive in the past, or to be so at the present time,

[1] For the Report of the Permanent Central Opium Board on its work in 1950 see vol. III, no. 2 of the *Bulletin on Narcotics*.

as compared with production in other countries and considering the population of Italy.

"So far as concerns, in particular, the production of heroin, which has been the subject of comments by the United Nations Commission on Narcotic Drugs, it is true that this has increased in recent years as compared with the pre-war period, higher consumption having been anticipated in view of the danger of tuberculosis spreading after the war.

"To prevent illicit traffic in narcotic drugs, control has been strengthened and the Italian police are now conducting large-scale investigations in collaboration with the United States police at Trieste — a town which, as has often been pointed out, is the focal point of the traffic in heroin.

"The Italian High Commissioner's Office for Hygiene and Public Health has already considered measures including, in particular, a new law on narcotic drugs laying down very strict rules with regard to the production of and trade in such drugs, and the establishment of an Inter-Ministerial Co-ordination Committee comprising the High Commissioner's Office and the Ministries of the Interior and Finance, to be responsible for co-ordinating all information on illicit traffic and organizing its suppression on a national scale.

"These measures will undoubtedly yield substantial results, especially if the necessary controls are strengthened in the Free Territory of Trieste.

"For the time being, new production of heroin has been prohibited until the present stocks have been completely disposed of and supervision over the trade in that drug has been intensified."

* * *

The Board communicated with the Iranian Government, emphasizing the great importance for the international control that this country should supply statistics for raw opium. In reply, Iran has now, for the first time in the past seventeen years, sent these statistics, including those of stocks, so that it has been possible to strike a balance, for the year 1950, of the quantities available and disposed of. This balance, based on the previous stock, the production and the exports declared by the Iranian Government, should amount to 589,668 kilogrammes, whereas the stock in hand on 31 December 1950, as declared by this Government, amounts to only 256,321 kilogrammes.

Thus, according to the statistics supplied by the Iranian Government, a quantity of 333 tons of raw opium has disappeared.

The question of diacetylmorphine

It will be recollected that during the past three years the Permanent Central Board and the Supervisory Body pointed out that the *per capita* consumption of diacetylmorphine in certain countries "had increased and was very high, although the 1931 Conference recommended the abolition or restriction of the use of this particularly dangerous drug".

The following table shows the consumption per million in recent years, as compared with 1936, in the six countries which have been particularly mentioned by the Board and Supervisory Body as having a markedly high consumption:

Consumption of diacetylmorphine per million inhabitants

	1936 kg.	*1946* kg.	*1947* kg.	*1948* kg.	*1949* kg.	*1950* kg.
Finland	6.98	25.54	17.67	38.15	16.93	5.2
Italy	3.4	2.71	5	4.26	4.16	2.31
New Zealand	0.64	4.54	3.33	2.72	2.13	1.04
Sweden	2.56	2.83	4.12	1.88	2.02	2.29
Australia	2.67	2.42	3.3	4.68	4.3	4.52
United Kingdom	1.1	1.91	1.87	2.18	2.71	2.27

The Board and the Supervisory Body were glad to note the decreases which emerge from this table, particularly in the case of Finland, hoping that the efforts made in this country to replace diacetylmorphine, whenever possible, by less dangerous products will achieve further reductions of the consumption of this drug. In Australia, where the competent authorities are following a similar policy, the increased consumption in 1950 should be followed by a decline in subsequent years.

The Board and the Supervisory Body were gratified to learn that the manufacture, trade and use of diacetylmorphine will be prohibited in Switzerland — except in the unlikely event of a referendum — beginning with January 1952. This is all the more significiant in that Switzerland has in the past manufactured diacetylmorphine not only for its domestic use, but also for export. The Board and the Supervisory Body also noted with approval that, in their estimated requirements of narcotic drugs for 1952, a number of countries or territories have for the first time omitted diacetylmorphine.

Synthetic narcotic drugs

Up to the beginning of 1951, international control exercised under the Conventions of 1925 and 1931 covered a score or so of narcotic drugs: opium, coca leaves, Indian hemp and the drugs derived from the first two of these. They are the narcotic drugs which could be described as "natural". During the year 1951 twelve synthetic narcotic drugs were brought under the provisions of the 1931 Convention by virtue of the Protocol of 19 November 1948.

Synthetic narcotic drugs made their appearance not more than about a dozen years ago; however, the manufacture and utilization of certain of them have expanded so rapidly that the problem of controlling these drugs has become acute. It will be sufficient

to state, in support of this assertion, that the *licit* consumption of one of them — pethidine — the effects of which are similar to those of morphine, quantitatively exceeds morphine consumption; and to note, so far as *illicit* utilization is concerned, the statement by some national authorities that pethidine, in certain regions, is the drug used in 28 per cent of drug-addiction cases, and that most morphine addicts have now switched to methodone (another synthetic narcotic drug) just as they did before to pethidine.

The adoption of the Protocol of 19 November 1948 and the placing of synthetic narcotic drugs under international control by virtue of that instrument were merely the preliminaries of any national or international action to counter the improper use of those drugs. Under the present organization of the control, the success of such action will depend primarily on the competent national authorities. Only they, indeed, can assume the responsibility for determining the medical and scientific requirements of their respective countries, the volume of supplies (manufacture, imports, stocks) to cover those requirements, and for exercising supervision over the use made of those supplies; medical practitioners carry a certain responsibility in ensuring that drugs are properly prescribed.

The following are, in the Board's opinion, the first steps which governments should take — if they have not already taken them — to enable their appropriate services to perform this function:

(i) All synthetic narcotic drugs, immediately on their appearance, should be made subject to the domestic legislation governing narcotic drugs.[2] At the date of the present report, this elementary precaution had not yet been adopted by all countries.

(ii) They should accede to the Protocol of 19 November 1948 without delay. At the date of the present report, only thirty-four States were Contracting Parties to that instrument.

(iii) They should only employ, as the customary names for those drugs, the international non-proprietary names given them by the World Health Organization in its International Pharmacopoeia (e.g., pethidine, for the hydrochloride of 1-methyl-4-phenyl-piperidine-4-carboxylic acid ethyl ester; methadone, for 4, 4-diphenyl-6-dimethylamino-heptanone-3). This suggestion should invariably be followed in national pharmacopoeias, faculties of medicine, medical prescriptions, labels on packages, import and export licences, relevant national and international statistics and estimates, etc. At the present time, some governments are furnishing the Board with separate estimates and statistics for pethidine, demerol and dolantin, presumably because they do not realize that these are different names for one and the same drug, already known by more than thirty names.

(iv) The measures for the repression of clandestine manufacture should be strengthened, for this manufacture is perhaps easier in the case of synthetic narcotic drugs than in that of "natural" narcotic drugs. Indeed, the raw materials for synthetic narcotic drugs are not themselves narcotics and are used for many other purposes, so that their movement cannot be controlled in the same way as that of opium and the coca leaf — the raw materials for "natural" narcotic drugs.

[2] In that connexion, the Expert Committee on Habit-forming Drugs of the World Health Organization made an important recommendation at its first session (January 1949): "that provision should be made in any new convention whereby substances of a particular chemical type, analogues of which had been proved to be habit-forming, could be placed under control until such time as they are shown not to be habit-forming". (document WHO/HFD/9/Rev.1)

Trends in the licit movement of narcotic drugs during 1950

This chapter sets forth the most significant facts regarding the trends in the licit movement of narcotic drugs during 1950. It forms, as it were, a sequel to the similar chapters in the preceding reports of the Board.

The statistics for 1950 supplied by governments to the Board under the international conventions of 1925 and 1931 were not yet complete. The extent to which the gaps affect the analysis which follows varies from substance to substance, and will be mentioned in the relevant paragraphs.

A. *Raw materials*

(1) *Opium*

Two important opium-producing countries, India and the USSR, did not yet report their 1950 production figure. It was therefore impossible to determine the volume reached by the world production this year. But, on the strength of the information supplied by other producing countries, it would seem that the downward trend noted for 1949 did not continue in 1950:

Production of raw opium

	1948 tons	*1949 tons*	*1950 tons*
India	342.2	220	?
Turkey	380.2	10.4	184.8
Iran	21.3	199.6	480.9
USSR	75	76	?
Yugoslavia	21.5	0.5	19.2
Bulgaria	4.4	0.7	?
Other countries.	0.1	—	0.2
TOTAL	844.7	507.2	685.1 (incomplete)

The amount of raw opium used for the manufacture of morphine was probably greater in 1950 than in 1949, considering that the figures of the USSR and India were not yet available for 1950:

Raw opium used for the manufacture of morphine

	1948 tons	*1949 tons*	*1950 tons*
In opium-producing countries .	96.5	85.7	6.8 (incomplete)
In other countries	343.5	325.4	364.3
TOTAL	440	411.1	371.1 (incomplete)

Assuming that the volume of this manufacture in the USSR and India was the same in 1950 as in 1949, the total amount of opium utilized for this purpose in 1950 would be 445.9 tons.

The amounts of opium shown in the above table produced 48 tons of morphine in 1948, 46.4 tons in 1949 and 43.1 tons in 1950, a yield of 10.9 per cent, 11.3 per cent and 11.6 per cent, respectively. In addition, morphine was manufactured from poppy straw (see below).

The only information of some importance supplied to the Board regarding *prepared (smoking) opium* with respect to the years 1949 and 1950 is as follows:

Prepared (smoking) opium

	Thailand		*Cambodia, Laos and Vietnam (Indo-China)*	
	1949 tons	*1950 tons*	*1949 tons*	*1950 tons*
Production of prepared opium	17.2	?	22.5	?
Raw opium used for this purpose	20.1	?	35	?
Consumption of prepared opium	16.5	?	9.7	10.2

The Board offered no comment on this matter, as it lies outside its field of competence.

(2) *Poppy straw*

This raw material of morphine is not covered by the international conventions on narcotic drugs. Most of the countries employing it, however, declare to the Board the amounts used in manufacture and the amounts of morphine thus produced. These amounts of morphine were 8.1 tons in 1948, 10.1 tons in 1949 and 10.9 tons in 1950. The figures relating to 1949 and 1950 do not include production in Czechoslovakia, this country not yet having reported it.

(3) *Coca leaves and crude cocaine*

So far as the Board was aware, there are at present four countries which produce coca leaves: Bolivia, Colombia, Indonesia and Peru. Only two of them, Colombia and Indonesia, declare their production figure (in 1950: 218 and 9.3 tons respectively); they are not the largest producers.

In addition, Peru, also a manufacturer of cocaine (chiefly crude cocaine), has not yet declared either the amount of coca leaves used in 1950 for this manufacture (in 1946-1949: an average of 136 tons per annum) or the amount of crude cocaine obtained (in 1946-1949: an average of 870 kilogrammes per annum). It is impossible, therefore, to calculate the corresponding world totals.

The Board was no better informed as to the amounts of coca leaves consumed (chewed) in two important coca-leaf producing countries — namely, Bolivia and Peru. In Colombia, the responsible authorities have declared that the amounts so consumed came to 180 tons in 1948, 170 tons in 1949 and 148 tons in 1950. Argentina is the only country not producing coca leaves in which the leaves were consumed in that manner: 181 tons in 1948, 313 tons in 1949 and 241 tons in 1950, imported from Bolivia and Peru.

In 1950, four cocaine-producing countries, the USA, the United Kingdom, France and Germany, together produced 1,163 kilogrammes of the drug, or 90 per cent of the world production that year; they imported the necessary raw materials: the USA coca leaves, and the other three countries crude cocaine. The amounts of raw materials used in 1950 for manufacturing cocaine in those countries are as follows:

Coca leaves:	
USA	130 tons
Crude cocaine:	
United Kingdom	254 kilogrammes
France	104 "
Germany	184 "

Lastly, the amounts of coca leaves used in the USA for the preparation of non-narcotic coca-flavoured beverages fell from 129 tons in 1947 to 6 tons in 1948 and nil in 1949 and 1950.

(4) *Indian hemp*

This plant is the basis of medicinal preparations which are not widely used (some 600 kilogrammes a year), and present no important problem. It is also the basis of non-medicinal products consumed by addicts in several parts of the world under the names of hashish, marihuana, charas, ganja, etc. The statistics to be supplied to the Board under the Convention of 1925 relate only to imports, exports, confiscations effected on account of illicit imports and exports, and also to the consumption and stocks of medicinal preparations. The Board, considering that such information depicts only a negligible part of the movement of these substances, has always refrained from commenting on it; the figures will be shown in the addendum to the Board's report to be published two or three months after the report itself.

B. *Manufactured drugs*

(1) *Morphine*

It is not at present possible to determine whether the steady increase in world production of morphine that has taken place in recent years continued in 1950, since the annual statistics of the USSR and Czechoslovakia are not yet available. Very probably, however, it has done so. Those two countries apart, 53.9 tons of the drug were produced in the world in 1950, as against 49.6 tons in 1949, an increase of 8.7 per cent. The production of the USSR was 7 tons in 1949, and that of Czechoslovakia 0.9 tons in 1948 (the 1949 production has not been reported). Assuming that the volume of production in those two countries was the same in 1950, the world total for this year would be 61.8 tons. That would be a new record, the highest figure previously recorded being 56.6 tons in 1949.

The upward trend did not appear in all producing countries; in some there was a pronounced decrease. The most considerable increases and decreases were as follows:

Production of morphine

	1949	*1950*	*Difference*	
	tons	*tons*	*tons*	*percentage*
(i) Increase:				
United States	15.2	19.8	+4.6	+30
United Kingdom ...	10.6	11.1	+0.5	+ 5
Germany	3.6	6.4	+2.8	+78
(ii) Decrease:				
France	6.4	5.9	—0.5	— 8
Switzerland	2.9	0.4	—2.5	—86
Yugoslavia	1.5	1	—0.5	—33

Morphine production figures, and figures for its conversion into other substances throughout the world, always follow a common trend, since the greater part (91 per cent) of morphine produced is so converted. The total world figures — the USSR and Czechoslovakia excluded — for morphine used for conversion rose from 45.4 tons in 1949 to 49.1 tons in 1950, an increase of 8 per cent. Assuming that the amounts used for conversion purposes in the two countries excluded were the same in 1950 as in 1948 or 1949, the world total for 1950 under this head would be 56.2 tons, a new record. Manufacture of codeine continued in 1950 to account for the greater part (85 per cent) of the morphine produced, and thus to be the determining factor in morphine production as regards both volume and trend.

The world total of morphine not subsequently converted into other drugs (i.e., of morphine available as such), excluding the figures for the USSR and Czechoslovakia, has remained more or less the same in 1950 as in 1949 (about 5 tons).

(2) *Diacetylmorphine*

With one exception, Czechoslovakia, all the countries engaged in licit manufacture of diacetylmorphine during the past five years have declared their production figures for this drug in 1950. The total thus declared for the whole world is 453 kilogrammes (the absence of Czechoslovak production figures is unlikely to affect the position, since the average annual figure over five years was less than 1 kilogramme). This total of 453 kilogrammes constitutes a decrease of 70 kilogrammes, or 13 per cent, compared with the total for the year 1949, and of 386 kilogrammes, or 46 per cent, with that for the year 1948.

(3) *Dihydrohydroxycodeinone, dihydrocodeinone, dihydromorphinone, acetyldihydrocodeinone and methyldihydromorphinone*

All the thirteen countries producing one or other of these drugs in the last five years have declared their 1950 production figures to the Board, with the exception of Czechoslovakia (average production in that country during the last five years, was, however, less than 1 kilogramme). The amount manufactured in the world in 1950 (788 kilogrammes) is 163 kilogrammes lower than in 1949 and 178 kilogrammes lower than the highest production figure ever recorded (966 kilogrammes in 1948).

(4) *Codeine*

It is already possible, in spite of the absence of figures for the USSR and Czechoslovakia, to state that world production of this drug increased in 1950, as it had regularly done during the previous years. Production rose from 45.2 tons in 1949 to 48.9 tons in 1950, and the first figure, but not the second, includes production in the USSR. Assuming the latter to have reached the same volume in 1950 as in 1949 (5.3 tons), the world total for 1950 would come to some 54 tons. That would be a new record, the previous record being 45.2 tons in 1949.

(5) *Dionine*

Production of dionine, on the other hand, dropped from 4.7 tons in 1949 (record figure) to 2.2 tons in 1950. The first of these figures, but not the second, includes production in the USSR. Assuming the latter to have reached the same amount in 1950 as in 1949, the world total for 1950 would be 2.7 tons. That would be the lowest figure recorded in several years.

(6) *Cocaine*

World production of cocaine decreased from 1,596 kilogrammes in 1949 to 1,284 kilogrammes in 1950. It is thus the smallest recorded by the Board.

According to the statistics supplied by the USSR, domestic cocaine production before the 1939-1945 war averaged about 270 kilogrammes a year and was used to meet the country's medical and scientific requirements. But since the end of the war, the USSR has reported no production of cocaine or its raw materials (coca leaves, ecgonine, crude cocaine) and no stocks of these substances.

(7) *Synthetic narcotic drugs*

Twelve synthetic narcotic drugs are at present subject to international control. One of them, pethidine (1-methyl-4-phenyl-piperidine-4-carboxylic acid ethyl ester in the form of the hydrochloride), is now used almost everywhere in the world as a substitute for morphine. It is only since March 1951 that synthetic narcotic drugs fall under the Convention of 1931, and not many statistics on the subject are yet available to the Board.

But even on the strength of very incomplete figures, it emerges that the licit production and consumption of pethidine are now larger than those of morphine (in terms of weight, if not of therapeutical potency), and, of course, this trend would be more marked if all the countries which have supplied statistics for morphine had also supplied them for pethidine.

Production of morphine as such and pethidine

Year	*Morphine as such* *Kg.*	*Pethidine* *Kg.*
1947	6,532	6,533
1948	5,838	5,512
1949	4,942	6,659
1950	4,805	7,423

Attention, however, should be drawn to the fact that the therapeutic potency of these two drugs is not the same. For example, it has been estimated that it takes from five to ten times as much pethidine to achieve the same analgesic effect as with morphine.

On the other hand, the use of another synthetic narcotic drug, methadone (4,4-diphenyl-6-dimethylamino-heptanone-3), which, two years ago, seemed to be gaining ground, is now decreasing. In the United States, for example, consumption of this drug fell from 1,397 kilogrammes in 1949 to 207 kilogrammes in 1950.

The utilization of the other ten synthetic narcotic drugs seems to be still very limited (or even nil, for some of them), perhaps because their appearance is much more recent than that of pethidine and methadone.

Conclusions

As can be seen from the foregoing paragraphs, the Board still lacks for 1950 certain statistics which are so important that it is impossible to calculate world production during that year of any one of the narcotic drugs subject to international control; the same difficulty exists with regard to other items — consumption, for example.

As far as opium and coca leaves are concerned, this situation is by no means new. It must be attributed to the fact that in certain countries the control of production and consumpion of those substances is almost non-existent and that the national authorities concerned have never been in a position to establish, with any degree of accuracy, the statistics provided for under the 1925 Convention.

In the case of "manufactured drugs", on the other hand, the gaps observed seem to be due to the unpunctuality of the governments of certain countries — generally the same ones year after year — rather than to any lack of control in those countries.

In spite of the absence of some important statistics of these drugs, the following trends are to be observed. The production of morphine and codeine continued to increase in 1950 and, without a doubt, reached a record figure during that year; on the other hand, the quantity of morphine produced for use as such — that is to say, excluding the morphine produced for conversion into other drugs — has remained stable during recent years. But allowance must be made for the fact that pethidine, a synthetic narcotic drug of almost world-wide use as a substitute for morphine since the end of the 1939-1945 war, is at present being turned out in quantities superior (in weight, though not in therapeutic potency), to the amount of morphine produced for use as such.

The production of a group of drugs comprising dihydrohydroxycodeinone, dihydrocodeinone, dihydromorphinone, acetyldihydrocodeinone and methyldihydromorphinone, which reached a record level in 1948, decreased slightly in 1949 and markedly in 1950. The production of diacetylmorphine, cocaine and dionine also decreased in 1950 (for cocaine it was the lowest ever recorded by the Board).